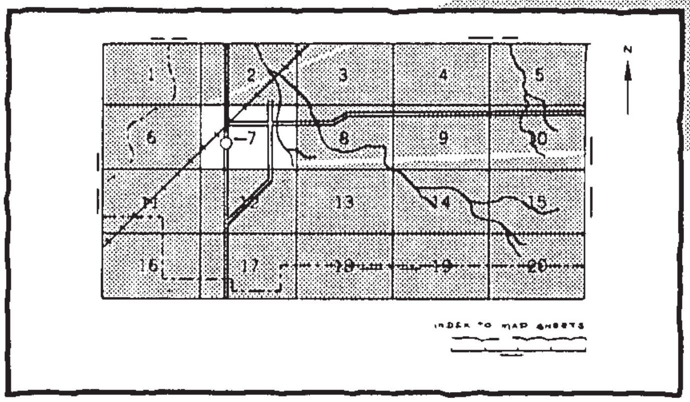
Soil Survey Of

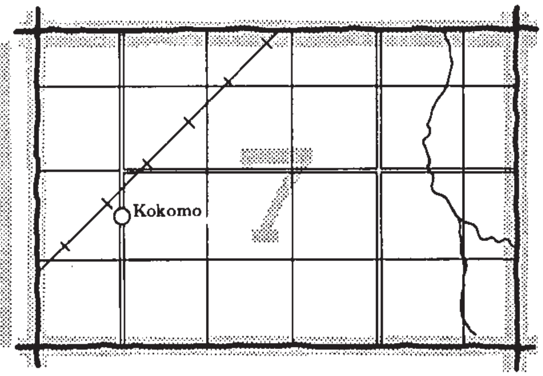
SEMINOLE COUNTY, OKLAHOMA

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Oklahoma Agricultural Experiment Station

HOW TO USE

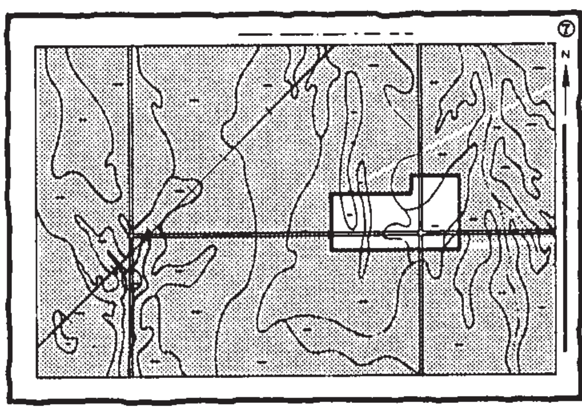
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

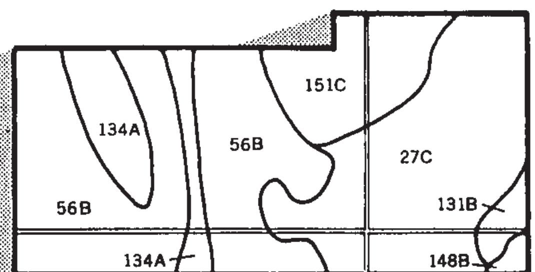




2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.





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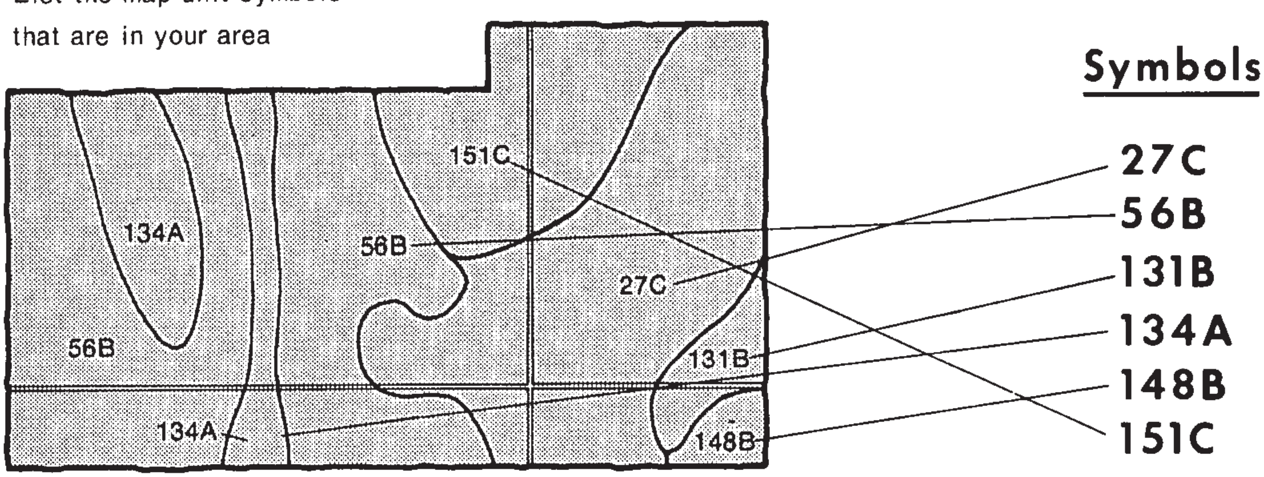
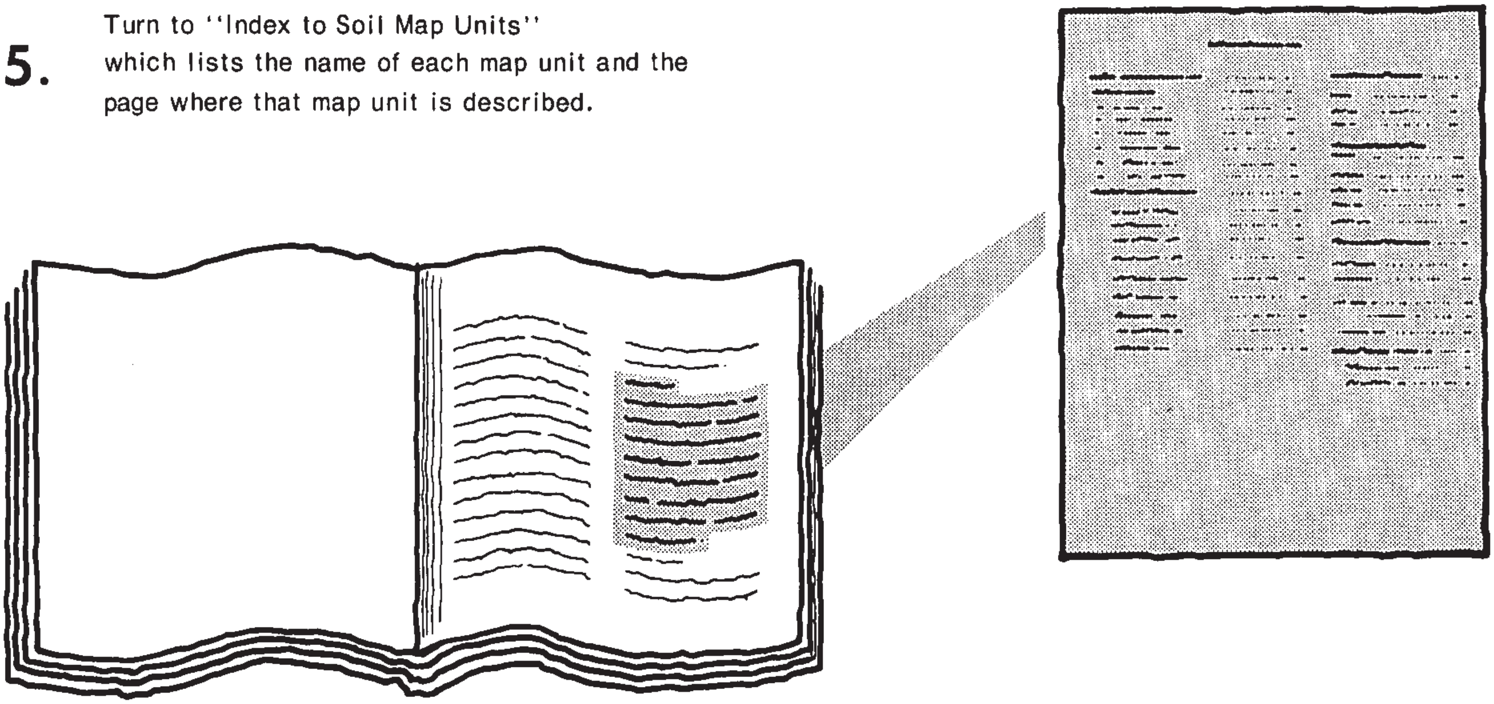
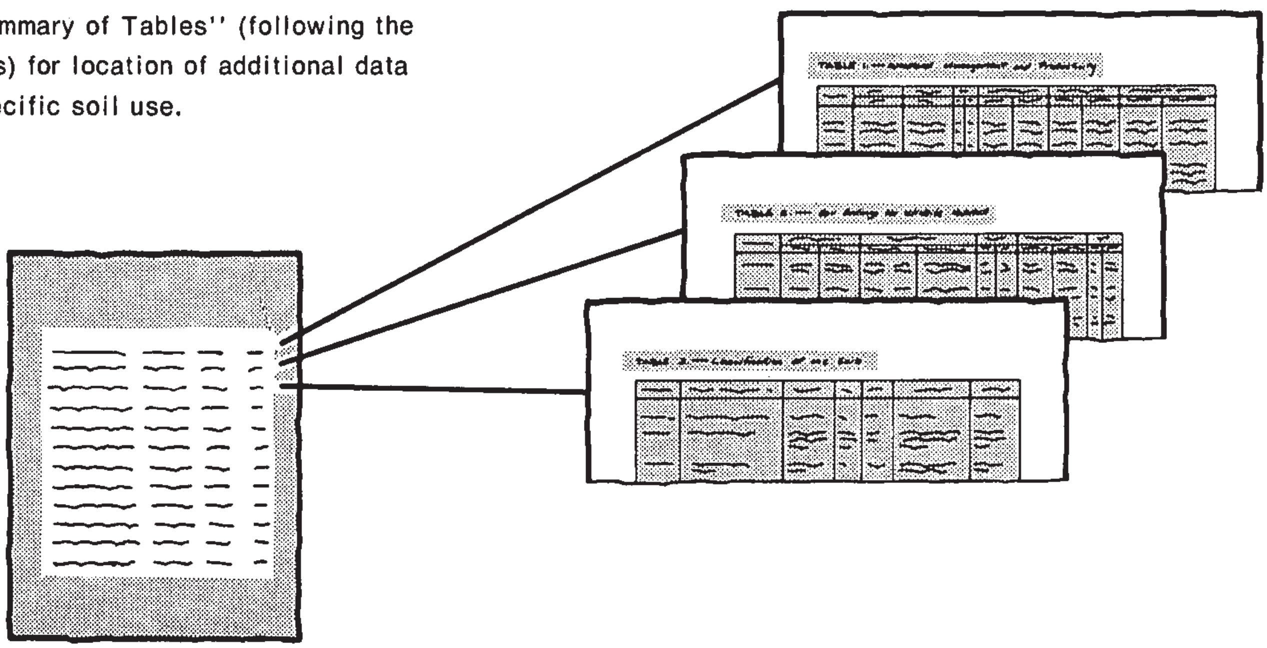


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1964-1975. Soil names and descriptions were approved in 1976. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1976. This survey was made cooperatively by the Soil Conservation Service and the Oklahoma Agricultural Experiment Station. It is part of the technical assistance furnished to the Seminole County Conservation District and the Konawa Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Contents

	Page
Index to soil map units	iv
Summary of tables	v
Foreword	vii
General nature of the county	1
Climate	1
How this survey was made	2
General soil map for broad land use planning	2
1. Stephenville-Darnell	3
2. Seminole-Chickasha-Grainola	3
3. Niotaze-Darnell-Wewoka	3
4. Gowton-Madill-Yahola	3
5. Konawa-Eufaula-Teller	4
6. Okemah-Bates-Prue	4
Broad land use considerations	4
Soil maps for detailed planning	5
Use and management of the soils	26
Crops and pasture	26
Management of soils for tame pasture	28
Yields per acre	29
Capability classes and subclasses	30
Rangeland	30
Windbreaks and environmental plantings	31
Engineering	32
Building site development	32
Sanitary facilities	33
Construction materials	34
Water management	35
Recreation	35
Wildlife habitat	36
Soil properties	37
Engineering properties	37
Physical and chemical properties	38
Soil and water features	39
Engineering test data	40
Soil series and morphology	40
Asher series	40
Aydelotte series	41
Bates series	42
Carytown series	42
Catoosa series	43
Chickasha series	44
Coweta series	44
Darnell series	45
Dennis series	45
Dougherty series	46
Eram series	47
Eufaula series	47
Gaddy series	48
Gowton series	48
Gracemont series	49
Gracemore series	49
Grainola series	50
Harjo series	50
Keokuk series	51
Konawa series	51
Lucien series	52
Madill series	52
Newtonia series	53
Niotaze series	53
Okemah series	54
Prue series	55
Roebuck series	55
Seminole series	56
Shidler series	57
Stephenville series	57
Teller series	58
Tullahassee series	58
Waurika series	59
Wewoka series	59
Wynona series	60
Yahola series	61
Classification of the soils	61
Formation of the soils	62
Factors of soil formation	62
Parent material	62
Climate	62
Plants and animals	62
Relief	62
Time	63
Processes of soil formation	63
References	63
Glossary	63
Illustrations	71
Tables	81

Issued March 1979

Index to Soil Map Units

	Page
1—Asher silty clay loam	6
2—Aydelotte loam, 2 to 5 percent slopes	6
3—Bates loam, 1 to 3 percent slopes	6
4—Bates loam, 3 to 5 percent slopes	7
5—Bates-Coweta complex, 2 to 5 percent slopes	7
6—Chickasha loam, 2 to 5 percent slopes	8
7—Dennis loam, 3 to 5 percent slopes	8
8—Dougherty loamy fine sand, 3 to 8 percent slopes (W)	8
9—Eram-Coweta complex, 3 to 12 percent slopes	9
10—Eufaula-Dougherty complex, 0 to 3 percent slopes (W)	9
11—Eufaula-Dougherty complex, 3 to 12 percent slopes (W)	10
12—Gaddy loamy fine sand	10
13—Gowton loam	11
14—Gowton soils	11
15—Gracemont fine sandy loam	11
16—Gracemore loamy fine sand	12
17—Grainola and Aydelotte soils, 3 to 8 percent slopes, severely eroded	12
18—Grainola-Lucien complex, 3 to 12 percent slopes	12
19—Harjo clay	13
20—Keokuk silt loam	13
21—Konawa fine sandy loam, 0 to 3 percent slopes	13
22—Konawa fine sandy loam, 3 to 5 percent slopes	14
23—Konawa fine sandy loam, 2 to 5 percent slopes, eroded	14
24—Konawa fine sandy loam, gullied	15
25—Madill fine sandy loam	15
26—Newtonia-Catoosa complex, 1 to 3 percent slopes	15
27—Niotaze-Darnell complex, 8 to 30 percent slopes	16
28—Niotaze-Wewoka complex, 3 to 12 percent slopes	16
29—Oil-waste land	17
30—Okemah silt loam, 0 to 1 percent slopes	17
31—Okemah silt loam, 1 to 3 percent slopes	17
32—Okemah-Carytown complex, 0 to 2 percent slopes	18
33—Pits	18
34—Prue loam, 1 to 3 percent slopes	18
35—Prue loam, 3 to 5 percent slopes	19
36—Roebuck clay	19
37—Seminole loam, 1 to 3 percent slopes	19
38—Seminole loam, 2 to 5 percent slopes, eroded	20
39—Seminole, Chickasha, and Prue soils, 2 to 8 percent slopes, severely eroded	20
40—Seminole-Gowton complex, 0 to 12 percent slopes	21
41—Shidler-Rock outcrop complex, 1 to 5 percent slopes	21
42—Stephenville fine sandy loam, 1 to 3 percent slopes	22
43—Stephenville fine sandy loam, 3 to 5 percent slopes	22
44—Stephenville-Darnell complex, 3 to 12 percent slopes	23
45—Stephenville-Darnell complex, 3 to 12 percent slopes, severely eroded	23
46—Teller loam, 1 to 3 percent slopes	24
47—Teller loam, 3 to 5 percent slopes	24
48—Tullahassee fine sandy loam	24
49—Waurika silt loam, 0 to 1 percent slopes	25
50—Wynona silt loam	25
51—Yahola fine sandy loam	26

Summary of Tables

	Page
Acreage and proportionate extent of the soils (Table 4)	84
Acres. Percent.	
Building site development (Table 9)	102
Shallow excavations. Dwellings without basements. Dwellings with basements. Small commercial buildings. Local roads and streets.	
Classification of the soils (Table 19)	142
Family or higher taxonomic class.	
Construction materials (Table 11)	110
Roadfill. Sand. Gravel. Topsoil.	
Engineering properties and classifications (Table 15)	125
Depth. USDA texture. Classification—Unified, AASHTO. Fragments more than 3 inches. Percentage passing sieve number—4, 10, 40, 200. Liquid limit. Plasticity index.	
Engineering test data (Table 18)	141
Parent material. Depth from surface. Shrinkage limit. Shrinkage ratio. Volume change. Mechanical analysis—Percentage passing sieve, Percentage smaller than. Liquid limit. Plasticity index. Classification—AASHTO, Unified.	
Freeze dates in spring and fall (Table 2)	83
Probability. Temperature.	
Grazing yields per acre (Table 5)	85
Improved bermudagrass. Fescue-bermudagrass. Fescue. Small grains. Forage sorghum.	
Growing season length (Table 3)	83
Probability. Daily minimum temperature during growing season.	
Physical and chemical properties of soils (Table 16)	133
Depth. Clay less than 2 mm. Moist bulk density. Permeability. Available water capacity. Soil reaction. Salinity. Shrink-swell potential. Erosion factors—K, T. Wind erodibility group. Organic matter.	
Rangeland productivity and characteristic plant communities (Table 7)......	91
Range site name. Total production—Kind of year, Dry weight. Characteristic vegetation. Composition.	
Recreational development (Table 13)	118
Camp areas. Picnic areas. Playgrounds. Paths and trails.	

Summary of tables—Continued

	Page
Sanitary facilities (Table 10) ... *Septic tank absorption fields. Sewage lagoon areas. Trench sanitary landfill. Area sanitary landfill. Daily cover for landfill.*	106
Soil and water features (Table 17) ... *Hydrologic group. Flooding—Frequency, Duration, Months. High water table—Depth, Kind, Months. Bedrock—Depth, Hardness. Cemented pan—Depth, Hardness.*	138
Temperature and precipitation data (Table 1) ... *Temperature—Average daily maximum, Average daily minimum, Average, Average number of growing degree days. Precipitation—Average, Average number of days with 0.10 inch or more, Average snowfall.*	82
Water management (Table 12) ... *Limitations for—Pond reservoir areas; Embankments, dikes, and levees; Aquifer-fed excavated ponds. Features affecting—Drainage, Irrigation, Terraces and diversions, Grassed waterways.*	114
Wildlife habitat potentials (Table 14) ... *Potential for habitat elements—Grain and seed crops, Grasses and legumes, Wild herbaceous plants, Hardwood trees, Coniferous plants, Shrubs, Wetland plants, Shallow-water areas. Potential as habitat for—Openland wildlife, Woodland wildlife, Wetland wildlife, Rangeland wildlife.*	122
Windbreaks and environmental plantings (Table 8) ... *Expected height of specified trees at 20 years of age.*	99
Yields per acre of crops and pasture (Table 6) ... *Wheat. Grain sorghum. Alfalfa hay. Soybeans.*	88

Foreword

The Soil Survey of Seminole County, Oklahoma contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

Roland R. Willis

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State Conservationist
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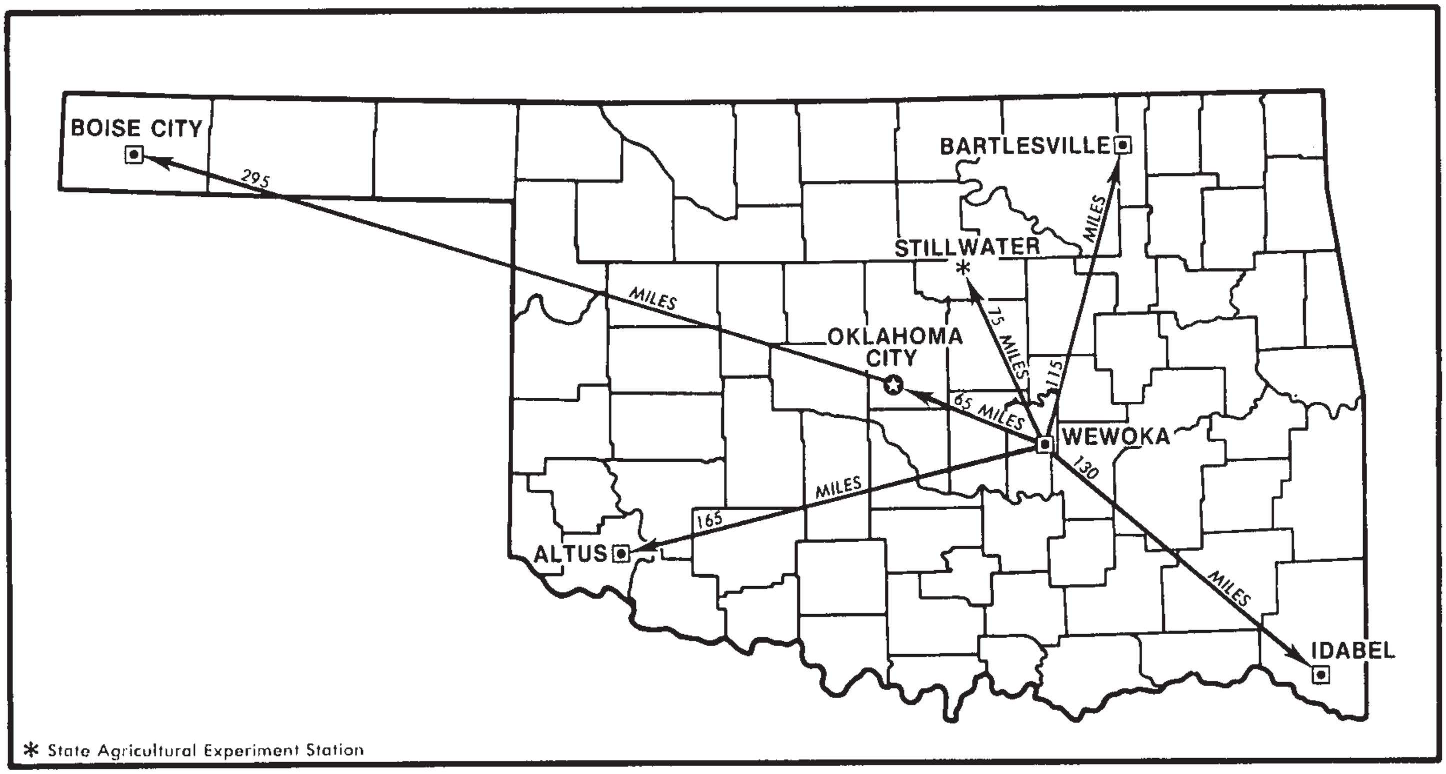

Location of Seminole County in Oklahoma.

SOIL SURVEY OF SEMINOLE COUNTY, OKLAHOMA

By Richard E. Mayhugh and Donald G. Bartolina

United States Department of Agriculture, Soil Conservation Service, in cooperation with Oklahoma Agricultural Experiment Station

SEMINOLE COUNTY, in the central part of Oklahoma, has an area of 404,480 acres (see map on facing page). The North Canadian and Canadian Rivers form its north and south boundaries. It is bounded on the west by Pottawatomie County and on the east by Okfuskee and Hughes Counties. Wewoka, the county seat, has a population of about 6,000 and is located in the east-central part of the county.

The county is largely rural, and the chief enterprise is raising livestock. Oil and gas production, as well as manufacturing, contribute to the economy.

General nature of the county

Seminole County was formerly part of Indian Territory, allotted to the Seminole and Creek Indians. Early settlers, other than Indian tribes, migrated into the county in the late 19th century. Most of these earlier settlers were tradesmen. Later, early in the 20th century, farmers largely from Texas and Arkansas settled in the county.

Most of the early inhabitants established small subsistence-type farms. Cotton, small grains, and alfalfa hay were the major cash crops. Other crops were grown to provide feed for hogs, chickens, dairy and beef cattle, and work stock.

Agriculture is still a major industry in Seminole County. Small grains, alfalfa, grain sorghum, peanuts, and soybeans are commonly grown. Pecans produce a good crop some years. Oil and gas production is also a major industry in the county, which was at its peak in the 1930's and 1940's.

The county has large deposits of chert gravel suitable for road construction. Shale deposits near Wewoka are used to produce brick and clay tile. Limestone is in a band from Wewoka to the Canadian River and in a small area near Sasakwa. In the past, several quarries operated to produce primarily crushed rock for road construction and concrete mixes.

Seminole County has a well-distributed system of highways that includes Interstate 40, U.S. 270, Oklahoma 3, 9, 39, 56, 59, 99, and 99A. It also has a good network of all-weather roads that are maintained by the county.

Seminole County was originally about 70 percent timber and about 30 percent prairie. The native vegetation in the timbered areas is mostly oak and hickory with an understory of grasses. In the prairie areas the native vegetation is mostly big and little bluestem, indiangrass, switchgrass, and forbs.

The major streams of the county enter from the west and generally flow eastward to the Arkansas River. The elevation of the county averages about 900 feet. Topography pattern in the county is a repeating series of ridges and valleys running generally in a north-south direction. The ridges and gentle, west-facing slopes are generally underlaid by sandstone, and the valleys and east-facing slopes are underlaid by shale. Tributaries of the major streams flow parallel to the ridges and valleys. Slopes are nearly level to steep in most of the county.

Climate

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Wewoka for the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 41 degrees F, and the average daily minimum temperature is 29 degrees. The lowest temperature on record, which occurred at Wewoka on January 11, 1962, is -9 degrees. In summer the average temperature is 80 degrees, and the average daily maximum temperature is 92 degrees. The highest recorded temperature, which occurred on July 24, 1954, is 112 degrees.

Growing degree days, shown in table 1, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature

each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 24 inches, or 65 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 6.43 inches at Wewoka on August 21, 1958. Thunderstorms occur on about 51 days each year, and most occur in summer.

Average seasonal snowfall is 7 inches. The greatest snow depth at any one time during the period of record was 6 inches. On the average, 1 day has at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 65 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The percentage of possible sunshine is 76 in summer and 60 in winter. The prevailing wind is from the southwest. Average windspeed is highest, 15 miles per hour, in March.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

The general soil map at the back of this publication shows, in color, map units that have a distinct pattern of soils and of relief and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The soils in the survey area vary widely in their potential for major land uses.

Each unit is rated for cultivated farm crops, urban uses, and tame pasture. Cultivated farm crops are those

grown extensively by farmers in the survey area. Urban uses include residential, commercial, and industrial developments. Tame pasture refers to land that is producing introduced grasses.

1. Stephenville-Darnell

Moderately deep to shallow, very gently sloping to strongly sloping, well drained loamy soils that formed under oak forest with an understory of grasses in material weathered from sandstone; on uplands

The soils in this map unit make up about 34 percent of the survey area. Areas are throughout the county. About 62 percent of the unit is Stephenville soils, 22 percent is Darnell soils, and the rest is soils of minor extent.

Stephenville soils are on side slopes and ridge crests and are moderately deep, very gently sloping to strongly sloping, and well drained. Darnell soils are on ridge crests and are shallow, very gently sloping to strongly sloping, and well drained.

About 60 percent of the soils in this map unit have been cleared and used for tame pasture or for a mixture of native plants and tame pasture plants. About 5 percent is used for small grains, grain sorghum, hay crops, and soybeans. The rest is wooded and used for grazing.

The principal concerns of management are controlling brush and, in cultivated areas, maintaining tilth and fertility and controlling erosion. The soils in this map unit respond to good management.

Most of the soils in this map unit have low potential for cultivated crops. The very gently sloping to gently sloping Stephenville soils have medium potential for crops, but these soils are in small areas. Potential is medium for tame pasture and native grasses on these soils. The soils in this map unit have medium potential for most urban uses. They have limitations for sewage lagoons or septic tank absorption fields because of the moderate to shallow depth to bedrock.

2. Seminole-Chickasha-Grainola

Deep to moderately deep, very gently sloping to strongly sloping, moderately well drained to well drained loamy soils that formed under grasses in material weathered from sandstone or shale; on uplands

The soils in this map unit make up about 18 percent of the survey area. Areas are mainly in the western part of the county. About 50 percent of the unit is Seminole or similar soils, 14 percent is Chickasha or similar soils, 6 percent is Grainola soils, and 30 percent is soils of minor extent.

Seminole soils generally are on broad ridge crests and are deep, very gently sloping to sloping, and moderately well drained. Chickasha soils generally are on broad ridge crests and are deep, very gently sloping to sloping, and well drained. Grainola soils generally are on side slopes and are moderately deep, gently sloping to strongly sloping, and well drained.

About 60 percent of the soils in this map unit are used for tame pasture or a mixture of tame and native plants. About 30 percent is rangeland or native meadows. Only about 10 percent is cultivated for crops such as small grains, grain sorghum, soybeans, and hay crops.

The principal concerns of management are maintaining soil structure and fertility and controlling erosion. The soils in this map unit respond favorably to good management.

The soils in this map unit have medium potential for cultivated crops. Most are erodible. They have medium potential for tame pasture. Potential for most urban uses is medium. Most of these soils have limitations for sewage lagoons and septic tank filter fields.

3. Niotaze-Darnell-Wewoka

Moderately deep and shallow, gently sloping to steep, somewhat poorly drained to somewhat excessively drained loamy soils that formed under oak forest with an understory of grasses in material weathered from sandstone, shale, or cherty conglomerate; on uplands

The soils in this map unit make up about 17 percent of the survey area. Areas are mostly in a band from the northeast corner to the center of the south boundary of the county. About 45 percent of the unit is Niotaze soils, 17 percent is Darnell soils, 15 percent is Wewoka soils, and 23 percent is soils of minor extent.

Niotaze soils are on side slopes and are moderately deep, gently sloping to steep, and somewhat poorly drained. Darnell soils are on ridge crests and are shallow, gently sloping to steep, and well drained. Wewoka soils are on ridge crests and are moderately deep, gently sloping to strongly sloping, and somewhat excessively drained.

Most of the soils in this map unit are wooded and used for grazing. About 2 percent of this map unit is barren areas, where the soil has been removed in order to remove the gravel.

The principal concerns of management are the steep slopes, stones, and gravel in the soil. The soils is this map unit respond favorably to good management.

The soils in this map unit have low potential for agricultural or urban uses. They are steep, stony, gravelly, shallow, or a combination of these. Yields for range forage are low. The best use of these soils is for range and wildlife. Some areas have gravelly soils that are suitable for gravel surfacing of roads and driveways.

4. Gowton-Madill-Yahola

Deep, nearly level, well drained loamy soils that formed under grasses in loamy sediment; on flood plains

The soils in this map unit make up about 15 percent of the survey area. Areas are throughout the county. About

45 percent of this unit is Gowton soils, 11 percent is Madill soils, 9 percent is Yahola soils, and 35 percent is soils of minor extent.

Gowton soils are mainly on larger creeks and are deep, nearly level, and well drained. Madill soils are mainly on tributaries to large creeks and are deep, nearly level, and well drained. Yahola soils are mainly on tributaries to large creeks and are deep, nearly level, and well drained.

Most soils is this map unit are cultivated. The main crops are alfalfa, small grains, grain sorghum, soybeans, hay crops, and tame pasture.

The principal concerns of management are maintaining soil structure and fertility and protecting the soils from damaging floods. Wetness is a concern on most of the minor soils in this map unit. The soils in this map unit respond favorably to good management.

The soils in this map unit have high potential for cultivated crops and tame pasture. Flooding is the chief limitation. Some minor soils have wetness problems and are better suited to pasture. Potential for most urban uses is low. Flooding is a severe limitation on most soils in this map unit.

5. Konawa-Eufaula-Teller

Deep, very gently sloping to strongly sloping, well drained to somewhat excessively drained loamy and sandy soils that formed under grasses or under oak forest with an understory of grasses in loamy and sandy sediments; on uplands

The soils in this map unit make up about 11 percent of the survey area. Areas are mostly along the north and south sides of the county, along the North Canadian and Canadian Rivers, and to a lesser degree along other minor streams in the county. About 70 percent of the map unit is Konawa soils, 10 percent is Eufaula soils, 8 percent is Teller soils, and the rest is soils of minor extent.

Konawa soils are mainly on broad ridge crests and are deep, very gently sloping to gently sloping, and well drained. Eufaula soils are on knolls or hummocks and are deep, very gently sloping to strongly sloping, and somewhat excessively drained. Teller soils are mainly on broad ridge crests and are deep, very gently sloping to gently sloping, and well drained.

Most of the soils in this soil map unit are used for tame pasture. About 10 percent is used for cultivated crops such as small grains, grain sorghum, soybeans, and hay crops. About 10 percent is wooded and used for grazing.

The principal concerns of management are maintaining tilth and fertility and controlling erosion. The soils of this map unit respond favorably to good management.

The soils in this map unit have medium potential for cultivated crops and tame pasture. Potential for most urban uses is high.

6. Okemah-Bates-Prue

Deep to moderately deep, nearly level to sloping, moderately well drained to well drained loamy soils that formed under grasses in material weathered from sandstone or shale; on uplands

The soils in this map unit make up about 5 percent of the survey area. Areas are in the eastern part of the county. About 23 percent of the unit is Okemah soils, 16 percent is Bates soils, 16 percent is Prue soils, and the rest is soils of minor extent.

Okemah soils are on broad, smooth slopes and are deep, nearly level to very gently sloping, and moderately well drained. Bates soils are on ridge crests or side slopes and are moderately deep, very gently sloping to gently sloping, and well drained. Prue soils are on side slopes and are deep, very gently sloping to sloping, and moderately well drained.

Most of the soils of this map unit are used for tame pasture. About 10 percent is used for cultivated crops such as small grains, grain sorghum, soybeans, and hay crops. About 20 percent is rangeland and native hay meadows and used for grazing.

The principal concerns of management are maintaining soil structure and fertility and controlling erosion. The soils of this map unit respond favorably to good management.

The soils in this map unit have medium potential for cultivated crops and high potential for tame pasture. They are mostly erodible, and some are droughty. The soils in this map unit have medium potential for most urban uses. Most soils have limitations for sewage lagoons or septic tank absorption fields.

Broad land use considerations

Deciding which land should be used for urban development is an increasingly important issue in the survey area. In the future, considerably more land may be developed for urban uses near Seminole, Wewoka, Konawa, and other cities in the county. It is estimated that about 7,000 acres, or less than 2 percent of the survey area, is now urban or built-up land. The general soil map is most helpful for planning the general outline of urban areas; it cannot be used for the selection of sites for specific urban structures. In general, in the survey area, the soils that have high potential for cultivated crops also have high potential for urban development. The data about specific soils in this survey can be helpful in planning future land use patterns.

Areas where the soils are so unfavorable that urban development is prohibitive are not extensive in the survey area. However, the Gowton-Madill-Yahola map unit is on flood plains where flooding and ponding are severe limitations. Many parts of the Niotaze-Darnell-Wewoka map unit have steep soils that have hard bed-

rock or shale at a few feet below the surface. Urban development is costly on these soils.

In large areas of the county are soils that can be developed for urban uses at lower costs than the soils named above. These include parts of the Konawa-Eufaula-Teller map unit that are not sandy, the Prue-Bates-Coweta map unit, the less sloping parts of the Stephenville-Darnell, and the deeper part of the Shidler-Newtonia-Stephenville map unit. The first two of these map units are excellent farmland, and this potential should not be overlooked when broad land uses are considered. The latter two map units are mainly soils that are underlaid by bedrock at a depth of less than 40 inches, but the rolling landscape, good soil drainage, and other soil qualities are favorable for residential and other nonfarm uses.

In some areas there are soils that have high potential for farming but low potential for nonfarm uses. In the Gowton-Madill-Yahola map unit, flooding is a limitation for nonfarm uses. It should be noted, however, that the soils have high potential for farming, and many farmers have provided sufficient flood protection for farm crops.

Most of the soils in the county have low potential for woodland. An exception is the soils of the Gowton-Madill-Yahola map unit. Mixed hardwood trees grow naturally and good wood crops are produced. Oak timber is native to the Stephenville-Darnell, Niotaze-Darnell-Wewoka, and the Konawa-Eufaula-Teller map units. The Konawa-Eufaula-Teller map unit consists of deeper soils. Trees grow larger and faster on these soils under native conditions. These soils had an understory of grasses and forbs, and the tree canopy was less dense.

The hilly Niotaze-Darnell-Wewoka map unit has high potential as sites for parks and extensive recreation areas. Hardwood forests enhance the beauty of much of this map unit. Marshes and wetlands of the Gowton-Madill-Yahola map unit are suitable for nature study areas. Both map units provide habitats for many important species of wildlife.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have profiles that are almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Bates loam, 1 to 3 percent slopes, is one of several phases within the Bates series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes, soil associations, and undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Bates-Coweta complex, 2 to 5 percent slopes, is an example.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pattern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Grainola and Aydelotte soils, 3 to 8 percent slopes, severely eroded, is an undifferentiated group in this survey area.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or

strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Oil-waste land is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

1—Asher silty clay loam. This deep, moderately well drained, nearly level soil is on flood plains of the major streams. This soil is rarely flooded. Slopes are plane to slightly concave. Individual areas range from 5 to over 200 acres.

Typically, the surface layer is dark gray silty clay loam about 12 inches thick. The subsoil is brown silty clay loam to a depth of 22 inches. The underlying material, to a depth of 60 inches, is pale brown very fine sandy loam with thin strata of brown silt loam and fine sandy loam and dark grayish brown silty clay loam.

Included with this soil is mapping, and making up about 10 percent of the mapped area, are soils that are similar but have a thicker subsoil. About 10 percent of the soils included in this map unit are Keokuk silt loams.

This soil is high in natural fertility and organic matter content. It is neutral or mildly alkaline in the surface layer. It ranges from neutral to moderately alkaline in the subsoil, and it is moderately alkaline in the underlying material. The subsoil is calcareous in places. The underlying material is calcareous. Permeability is slow, runoff is slow, and available water capacity is high. This soil generally has good tilth, but should be worked through a narrow range in moisture content. The root zone is deep and is easily penetrated by plant roots.

This soil has high potential for growing row crops, small grains, hay, and pasture. The potential is somewhat limited by the silty clay loam surface layer. This limitation can be overcome by proper management. During extended periods of above-normal rainfall, alfalfa stands may be damaged. Surface drainage is needed in some areas. Good tilth is maintained by returning crop residue to the soil. Minimum tillage and use of cover crops, including grasses and legumes in the cropping system, help to reduce runoff and to improve permeability and tilth.

This soil has low potential for urban uses. Flooding and low strength are the main limitations. This soil is rarely flooded by the main stream, but some areas are occasionally flooded by streams that drain the adjacent uplands.

This soil is in capability subclass IIw and the Loamy Bottomland range site.

2—Aydelotte loam, 2 to 5 percent slopes. This deep, well drained, very gently sloping to gently sloping soil is on upland ridges and side slopes. Slopes are plane and convex. Individual areas range from 5 to 100 acres.

Typically, the surface layer is reddish brown loam about 5 inches thick. The upper part of the subsoil is reddish brown clay to a depth of about 40 inches. The lower part of the subsoil is red clay to a depth of 62 inches.

Included with this soil in mapping, and making up about 12 percent of this map unit, are areas of Seminole loam, Grainola clay loam, Waurika silt loam, and Chickasha loam. Individual areas are generally less than 3 acres in size.

This soil is low in natural fertility and organic matter content. It ranges from slightly acid or neutral in the surface layer to moderately alkaline in the lower part of the subsoil. Permeability is very slow, and runoff is medium or rapid. Available water capacity is high. This soil has fair to poor tilth, and should be worked through a narrow range in moisture content. The root zone is deep, but the subsoil is not easily penetrated by plant roots.

This soil has low potential for row crops and small grains. Potential is limited by the thin surface layer over the clayey subsoil. This soil has medium potential for hay and pasture. Under good management, medium yield can be obtained. Tilth can be improved by returning crop residue to the soil. Erosion is a moderate hazard if cultivated crops are grown. Minimum tillage and the use of cover crops and soil-improving crops, including grasses and legumes in the cropping system, help to reduce runoff and to control erosion.

This soil has low potential for most urban uses. Low strength and high shrink-swell potential are the main limitations for most uses. In most instances these limitations can be overcome by careful design. Very slow permeability is a limitation for septic tank absorption fields.

This soil is in capability subclass IVe and the Claypan Prairie range site.

3—Bates loam, 1 to 3 percent slopes. This moderately deep, well drained, very gently sloping soil is on upland ridges. Slopes are plane to convex. Individual areas range from 5 to 100 acres. This soil is in the eastern one-third of the county.

Typically, the surface layer is dark grayish brown loam about 13 inches thick. The upper part of the subsoil is brown loam to a depth of about 20 inches. The lower part of the subsoil is brown sandy clay loam to a depth of about 38 inches. Below that is yellowish brown sandstone.

Included with this soil in mapping, and making up about 20 percent of the mapped area, are soils that are

similar but have sandstone at a depth of 40 to 60 inches or clay at a depth of 30 to 60 inches. About 10 percent is Carytown silt loam, and another 10 percent is Prue loam.

This soil is high in natural fertility and organic matter content. It ranges from medium acid to neutral. Permeability is moderate and runoff and available water capacity are medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is moderately deep and is easily penetrated by plant roots.

This soil has high potential for growing row crops, small grains, hay, and pasture crops. Good tilth and fertility are easily maintained by returning crop residue to the soil and by adding moderate amounts of fertilizer. The erosion hazard is moderate on cropland. Terracing is essential to prevent excessive soil loss. Minimum tillage and cover crops help to reduce runoff and to control erosion.

This soil has medium potential for urban use. Moderate shrink-swell potential and the moderate depth to rock are the main limitations for dwellings and small commercial buildings. Sandstone at moderate depths is a limitation for septic tank absorption fields.

This soil is in capability subclass IIe and the Loamy Prairie range site.

4—Bates loam, 3 to 5 percent slopes. This moderately deep, well drained, gently sloping soil is on narrow ridges and side slopes of uplands. Slopes are plane to convex and range from 200 to 2,000 feet in length. Individual areas range from 5 to more than 200 acres.

Typically, the surface layer is grayish brown loam about 14 inches thick. The upper 7 inches of the subsoil is brown loam and the lower part of the subsoil is yellowish brown clay loam to a depth of 32 inches. Below that is yellowish brown sandstone.

Included with this soil in mapping are about 5 percent Coweta loam in narrow bands, 8 percent Carytown silt loam, and 10 percent Prue loam. Also included in mapping, and making up about 15 percent of the mapped area, are soils that are similar to the Bates soil but have a thicker surface layer or a depth to sandstone that is more than 40 inches. These soils are in areas up to 5 acres in size and are scattered throughout the map unit.

This soil is high in natural fertility and organic matter. It ranges from medium acid to neutral throughout. Permeability is moderate, runoff is rapid, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is moderately deep and is easily penetrated by plant roots.

This soil has medium potential for row crops and small grains. It has high potential for hay and pasture. Good tilth and fertility are easily maintained by returning crop residue to the soil and adding moderate amounts of fertilizer. The erosion hazard is high on cropland, especially where row crops are grown. Terracing is essential to prevent excessive soil loss. Minimum tillage and cover crops help to reduce runoff and erosion.

This soil has medium potential for most urban uses. Moderate shrink-swell potential and moderate depth to rock of this soil are the main limitations for dwellings and small commercial buildings. Sandstone at moderate depths is a limitation for septic tank absorption fields.

This soil is in capability subclass IIIe and the Loamy Prairie range site.

5—Bates-Coweta complex, 2 to 5 percent slopes. This map unit is made up of very gently sloping to gently sloping soils on uplands. The moderately deep, well drained Bates soil is on side slopes, between areas of the shallow, well drained Coweta soil on ridge crests and side slopes. The Coweta soil is continuous around areas of the Bates soil. These soils are so intermingled that they are not shown separately on the soil map. Mapped areas range from 10 to 200 acres. Individual areas of the Bates soil range from 1/4 acre to 4 acres.

Bates fine sandy loam makes up about 40 percent of each mapped area. Typically, the surface layer is very dark grayish brown fine sandy loam about 9 inches thick. The upper part of the subsoil is dark brown loam to a depth of about 15 inches. The lower part of the subsoil is brown clay loam to a depth of about 25 inches. The underlying material is yellowish brown sandstone.

This soil is high in natural fertility and organic matter content. Permeability is moderate, runoff is rapid, and available water capacity is medium. This soil has good tilth and can be worked throughout a fairly wide range in moisture content. The root zone is moderately deep and is easily penetrated by plant roots.

Coweta fine sandy loam makes up about 35 percent of each mapped area. Typically, the surface layer is brown fine sandy loam about 9 inches thick. The subsoil is brown fine sandy loam to a depth of about 14 inches. The underlying material is yellowish brown sandstone.

This soil is medium in natural fertility and organic matter content. It is medium acid to neutral throughout. Permeability is moderate, runoff is rapid, and available water capacity is low. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is shallow and easily penetrated by plant roots.

Included with these soils in mapping are about 25 percent other soils. About 10 percent is a soil similar to the Bates soil but has sandstone at a depth of 40 to 60 inches. About 10 percent is soils that are seepy and along the lower side slopes. About 4 percent is a soil similar to the Bates soil but has gray mottles in the subsoil. About 1 percent is Carytown silt loam. Less than 1 percent is outcrops of sandstone that are in some areas but are usually less than 10 feet across.

The soils in this complex have low potential for crops and medium potential for tame pasture and hay. Shallow depth to rock is the main limitation. The soils are

droughty, and the production of crops and pasture in dry years is low.

The soils in this complex have medium potential for most urban uses. The moderate shrink-swell potential of the Bates soil, the shallow depth to rock of the Coweta soil, and the moderate depth to rock of the Bates soil are the main limitations for dwellings and small commercial buildings. The moderate to shallow depth to sandstone is the main limitation for septic tank absorption fields. This may be overcome by using a larger absorption area or by increasing the depth to bedrock.

These soils are in capability subclass IVe. The Bates soil is in the Loamy Prairie range site, and Coweta soil is in the Shallow Prairie range site.

6—Chickasha loam, 2 to 5 percent slopes. This deep, well drained, very gently sloping to gently sloping soil is on upland ridges and side slopes. Slopes are plane and convex. Individual areas range from 10 to more than 100 acres.

Typically, the surface layer is grayish brown loam about 10 inches thick. The upper part of the subsoil is brown loam to a depth of about 18 inches. The middle part of the subsoil is yellowish brown clay loam to a depth of about 32 inches and light yellowish brown sandy clay loam to a depth of about 48 inches. The lower part of the subsoil is coarsely mottled light gray, strong brown, and red sandy clay loam to a depth of about 56 inches. The underlying material is weathered, yellowish brown sandstone.

Included with this soil in mapping, and making up about 15 percent of the mapped area, is Seminole loam. About 10 percent is a soil that is similar to Chickasha loam but has sandstone at a depth of 20 to 40 inches. About 2 percent is a soil less than 20 inches thick over sandstone with an occasional outcrop.

This soil is high in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer and upper part of the subsoil, and it ranges from slightly acid to moderately alkaline in the lower part of the subsoil. Permeability is moderate, runoff is rapid, and available water capacity is high. This soil has good tilth, but tilth will deteriorate if the soil is worked when too wet. The root zone is deep and is easily penetrated by plant roots.

This soil has medium potential for row crops and small grains. Its potential is limited by slope and the erosion hazard. This soil has high potential for hay and pasture. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard where cultivated crops are grown. Terraces, minimum tillage, and the use of cover crops, including grasses and legumes in the cropping system, help to reduce runoff and to control erosion.

This soil has high potential for most urban uses. Depth to rock and low strength are the main limitations, but they can be overcome by good design and careful installation.

This soil is in capability subclass IIIe and the Loamy Prairie range site.

7—Dennis loam, 3 to 5 percent slopes. This deep, moderately well drained, gently sloping soil is on upland slopes. The slopes are plane to convex. Individual areas range from 5 to 50 acres. This soil is in the eastern one-third of the county.

Typically, the surface layer is dark grayish brown loam about 13 inches thick. The upper part of the subsoil is brown clay loam to a depth of about 23 inches. The middle part of the subsoil, to a depth of about 48 inches, is light yellowish brown clay. The lower part of the subsoil, to a depth of about 72 inches, is coarsely mottled brownish, grayish, and yellowish clay.

Included with this soil in mapping are soils that are similar but have an alkaline subsoil or shale bedrock at a depth of 40 to 60 inches. These soils make up 15 percent of the mapped area. About 5 percent is Carytown soils.

This soil is high in natural fertility and high in organic matter content. It ranges from medium acid to neutral in the surface layer and from slightly acid to moderately alkaline in the subsoil. Permeability is slow, runoff is rapid, and available water capacity is high. This soil has good tilth, but tillage is sometimes delayed because the soil is slow to dry. The root zone is deep and is easily penetrated by plant roots. This soil has a perched water table at a depth of 2 to 3 feet during winter and spring.

This soil has medium potential for growing row crops and small grains. Runoff and erosion are hazards that lower crop yields. This soil has high potential for tame pasture and hay crops. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard on cropland. Terracing is essential to prevent excessive erosion. Minimum tillage and use of cover crops, including grasses and legumes in the cropping system, help to reduce runoff and to control erosion.

This soil has medium potential for urban uses. The high shrink-swell potential and low strength are limitations, but they can be overcome by special design and careful installation. The slow permeability in the subsoil is a limitation for septic tank absorption fields, but this can be overcome by increasing the size of the absorption area or by modifying the filter field.

This soil is in capability subclass IIIe and the Loamy Prairie range site.

8—Dougherty loamy fine sand, 3 to 8 percent slopes (W). This deep, well drained, gently sloping to sloping soil is on broad uplands. Slopes are plane and slightly convex.

Typically, the surface layer is brown loamy fine sand about 10 inches thick. The subsurface layer is light brown loamy fine sand to a depth of 34 inches. The upper part of the subsoil is yellowish red sandy clay loam to a depth of about 48 inches, and the lower part of the subsoil is reddish yellow fine sandy loam to a

depth of about 72 inches. The underlying material is reddish yellow loamy fine sand to a depth of 80 inches.

Included with this soil in mapping are soils that are similar but in which the loamy fine sand surface layer and subsurface layer extend to a depth of about 40 to 65 inches. About one-fourth of these soils have bright mottles in the lower part of the subsurface layer. These soils make up about 10 percent of the map unit. Konawa soils make up about 10 percent of the map unit. They are mostly on the ridgetops or crests of slopes.

This soil is low in natural fertility and organic matter content. It ranges from strongly acid to slightly acid in most horizons. Permeability is moderate, runoff is medium, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

This soil has low potential for growing crops. Potential is somewhat limited by the medium available water capacity and high wind erosion hazard, which also limits the kind of crops that can adapt. Sown crops are difficult to establish because of wind erosion. This soil has medium potential for hay and tame pasture. Good tilth is easily maintained by returning crop residue to the soil, thus reducing the wind erosion hazard. Minimum tillage and use of cover crops help to control erosion.

This Dougherty soil has high potential for most urban uses. Low strength is a limitation for local roads and streets. Shallow-rooted lawn grasses are rather difficult to establish and maintain, especially where the sandy surface and subsurface layers are the thickest.

This soil is in capability subclass IVe and the Deep Sand Savannah range site.

9—Eram-Coweta complex, 3 to 12 percent slopes. This map unit consists of gently sloping to strongly sloping soils on uplands. The moderately deep, moderately well drained Eram soil is on side slopes between areas of the shallow, well drained Coweta soil on ridge crests and side slopes. These soils are so intermingled that they are not shown separately on the soil map. The areas are long and narrow and range from 120 to 500 feet in width and 1/2 mile to 2 miles in length. Individual areas of each soil range from 1/4 acre to 10 acres.

Eram loam makes up about 60 percent of the map unit. Typically, the surface layer is grayish brown clay loam about 11 inches thick. The subsoil is grayish brown clay to a depth of about 30 inches. The underlying material is grayish brown clay and shale.

This soil is high in natural fertility and organic matter content. Permeability is slow, runoff is rapid, and available water capacity is medium. This soil is slightly acid or neutral in the surface layer and becomes moderately alkaline in the subsoil and underlying material. It has a perched water table at a depth of 2 to 3 feet during winter and spring months. The root zone is moderately deep, but the subsoil is not easily penetrated by plant roots.

Coweta loam makes up about 25 percent of each mapped area. Typically, the surface layer is brown loam to a depth of about 8 inches and has 15 percent flat fragments of sandstone. The subsoil is brown loam to a depth of about 16 inches and has 15 percent flat fragments of sandstone. The underlying material is soft sandstone.

This soil is medium in natural fertility and organic matter content. Permeability is moderate, runoff is rapid, and available water capacity is low. This soil ranges from neutral to medium acid throughout. The root zone is shallow but is easily penetrated by roots.

Bates, Gowton, and Prue soils make up the remaining 15 percent of this map unit.

The soils in this complex have low potential for cultivated crops. They have limitations for use as cropland or hay meadows because of strong slopes. They have low potential for tame pasture because of the shallow Coweta soil and the slowly permeable Eram soil. The soils in this complex have low potential for urban use. The low strength, moderate depth to rock, and high shrink-swell potential of the Eram soil and the shallow depth to rock of the Coweta soil are limitations for most urban uses. Strong slopes are an additional limitation for urban uses.

These soils are in capability subclass VIe. The Eram soil is in the Loamy Prairie range site, and the Coweta soil is in the Shallow Prairie range site.

10—Eufaula-Dougherty complex, 0 to 3 percent slopes (W). This map unit consists of nearly level to very gently sloping soils on uplands. The deep, somewhat excessively drained Eufaula soil is on ridges between areas of the deep, well drained Dougherty soil in concave or depressional areas. These soils are so intermingled that they are not shown separately on the soil map. Mapped areas range from 10 to 40 acres. Individual areas of each soil range from 1/2 acre to 4 acres.

Eufaula fine sand makes up about 40 percent of each mapped area. Typically, the surface layer is brown loamy fine sand about 4 inches thick. The subsurface layer to a depth of 38 inches, is light yellowish brown fine sand. The subsoil, to a depth of 72 inches, is reddish yellow fine sand with yellowish red bands of loamy fine sand 1/8 to 1 inch thick and 1 inch to 5 inches apart.

This soil is low in natural fertility and organic matter content. It ranges from medium acid to neutral. Permeability is rapid, runoff is slow, and available water capacity is low. The root zone is deep and is easily penetrated by plant roots.

Dougherty loamy fine sand makes up about 35 percent of each mapped area. Typically, this soil has a brown loamy fine sand surface layer about 8 inches thick and a light reddish brown loamy fine sand subsurface layer to a depth of 22 inches. The upper part of the subsoil is red sandy clay loam to a depth of about 40 inches. The lower part of the subsoil is red fine sandy loam to a

depth of about 72 inches. The underlying material is red fine sand.

This soil is low in natural fertility and organic matter content. Reaction ranges from slightly acid to strongly acid in the surface layer, subsurface layer, and subsoil and ranges from neutral to strongly acid in the underlying material. Permeability is moderate, runoff is slow, and available water capacity is medium. The root zone is deep and is easily penetrated by plant roots.

About 15 percent of the map unit is soils that are similar to the Eufaula soil but have a dark brown or dark reddish brown fine sandy loam surface layer about 10 to 20 inches thick and are in low areas that receive runoff from adjacent uplands. About 5 percent of this map unit is soils that are similar to the Dougherty soil but have 10 to 18 percent clay in the subsoil. Konawa soils make up the remaining 5 percent and are mostly on low ridges.

The soils in this map unit have low potential for row crops and small grains. Potential is limited because of the low available water capacity. These soils have medium potential for hay and tame pasture. Wind erosion is a severe hazard on cropland. Minimum tillage, the return of crop residue to the soil, and cover crops help to control erosion.

The soils in this map unit have high potential for most urban uses. They are suited to dwellings, small commercial buildings, and septic tank absorption fields. The rapid permeability of the Eufaula soil and the moderate permeability of the Dougherty soil are the main limitations for sewage lagoons and sanitary landfills. Establishment and maintenance of vegetation is a problem because of droughtiness.

These soils are in capability subclass IVs and the Deep Sand Savannah range site.

11—Eufaula-Dougherty complex, 3 to 12 percent slopes (W). This map unit is made up of gently sloping to strongly sloping soils on uplands. The deep, somewhat excessively drained Eufaula soil is on ridges between areas of the deep, well drained Dougherty soil in concave or depressional areas. These soils are so intermingled that they are not shown separately on the soil map. Mapped areas range from 25 to more than 500 acres in size. Individual areas of each soil range from 1/4 acre to 4 acres.

Eufaula fine sand makes up about 50 percent of each mapped area. Typically, the surface layer is light brownish gray fine sand about 3 inches thick. The subsurface layer is light gray fine sand to a depth of about 60 inches. The subsoil to a depth of 80 inches is very pale brown fine sand with thin bands of yellowish red loamy fine sand ranging from 1/8 to 1/2 inch in thickness and 2 to 4 inches apart.

This soil is low in natural fertility and organic matter content. It ranges from medium acid to neutral. Permeability is rapid, runoff is slow, and available water capacity is low. The root zone is deep and is easily penetrated by plant roots.

Dougherty loamy fine sand makes up about 30 percent of each mapped area. Typically, the surface layer is light brownish gray loamy fine sand about 3 inches thick. The subsurface layer is light gray loamy fine sand to a depth of about 28 inches. The upper part of the subsoil is yellowish red sandy clay loam to a depth of about 44 inches. The lower part of the subsoil is reddish yellow sandy clay loam to a depth of about 54 inches. The underlying material is reddish yellow fine sandy loam to a depth of 64 inches.

This soil is low in natural fertility and organic matter content. Reaction ranges from slightly acid to strongly acid in the surface and subsurface layers and in the subsoil. It ranges from neutral to strongly acid in the underlying material. Permeability is moderate, runoff is slow, and available water capacity is medium. The root zone is deep and is easily penetrated by plant roots.

Included with these soils in mapping is about 20 percent other soils. These soils are Konawa fine sandy loam; a soil that is similar to the Dougherty soil but has less than 18 percent clay in the subsoil; and another soil that is similar to the Dougherty soil, but its subsoil is mottled in shades of gray and red at a depth of more than 40 inches.

The soils in this map unit have very low potential for row crops or small grains and medium potential for hay and tame pasture. The erosion hazard is high, and soils are droughty. Low water holding capacity greatly reduces yield. Good pasture management is needed to prevent erosion.

The soils in this map unit have medium potential for most urban uses. Slopes of more than 8 percent are a limitation for most uses. The rapid permeability of the Eufaula soil and the moderate permeability of the Dougherty soil are limitations for sewage lagoons and sanitary landfills. These soils are suitable for septic tank absorption fields where slopes are less than 8 percent. Establishment and maintenance of vegetation is difficult because of the droughtiness of these soils.

These soils are in capability subclass VIe and the Deep Sand Savannah range site.

12—Gaddy loamy fine sand. This deep, somewhat excessively drained, nearly level to very gently undulating soil is on flood plains of the major streams and is occasionally flooded. Individual areas range from 10 to over 300 acres.

Typically, the surface layer is brown loamy fine sand about 8 inches thick. The underlying material to a depth of 30 inches is light brown loamy fine sand and, to a depth of 60 inches, is pink fine sand.

Included with this soil in mapping is about 10 percent Yahola fine sandy loam. About 15 percent of this map unit is hummocky.

This soil is low in natural fertility and organic matter content. It is mildly alkaline or moderately alkaline in the surface layer and moderately alkaline and calcareous in the underlying material. Permeability is rapid, runoff is

slow, and available water capacity is low. It has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

This soil has low potential for growing row crops and small grains. Because of the low available water capacity and low fertility levels, high yields are difficult to obtain. This soil has high potential for hay and tame pasture. Good tilth is easily maintained by returning crop residue to the soil. Flooding is a hazard and will occasionally cause loss of crops. Cover crops help to reduce wind erosion and scouring during floods.

This soil has low potential for urban uses. Flooding is the main limitation, and it is difficult to overcome. This soil has medium potential for wildlife and most recreational uses, but has low potential for camp areas because of flooding.

This soil is in capability subclass IIIs and the Sandy Bottomland range site.

13—Gowton loam. This deep, well drained, nearly level soil is on flood plains of mainly small streams and is occasionally flooded (fig. 1). Slopes are plane. Individual areas are long and narrow and range from 50 to more than 200 acres.

Typically, the dark gray loam surface layer extends to a depth of about 12 inches. Below this, to a depth of 28 inches, is gray loam. Next is yellowish brown clay loam to a depth of about 42 inches. The underlying material to a depth of about 80 inches is light yellowish brown and brownish yellow mottled clay loam that is stratified with thin layers of loam.

About 25 percent of this map unit has a fine sandy loam surface layer that ranges from 3 to 15 inches in thickness and is yellowish brown. Included with this soil in mapping, and making up about 10 percent of the mapped area, are Wynona soils. Also included are small areas of soils that are similar to the Gowton soil but have more sandy layers or buried soils below a depth of 30 inches that have more clayey layers.

This soil is high in natural fertility and organic matter content. It ranges from medium acid to neutral in the upper part of the soil and from slightly acid to moderately alkaline in the underlying material. Permeability is moderate, runoff is slow, and available water capacity is high. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by roots.

This soil has high potential for row crops, small grains, pasture, and hay crops. Good tilth and fertility are easily maintained by returning crop residue and adding moderate amounts of fertilizer. Flooding causes an occasional loss of crop and deposition of sediment near the channel. Minimum tillage and cover crops help to reduce runoff and to control erosion.

This soil has low potential for urban use. Flooding is a limitation for dwellings, small commercial buildings, septic tank absorption fields, and most other urban uses.

This soil is in capability subclass IIw and the Loamy Bottomland range site.

14—Gowton soils. This map unit consists of deep, well drained, nearly level soils on flood plains of narrow creeks. They are in the upper reaches of the drainage area within the more sandy uplands. These soils are frequently flooded. In a typical area, the flood plain ranges from 100 to 600 feet in width but averages 300 feet. Areas range from 10 to 100 acres. The surface layer is fine sandy loam, loam, or clay loam.

Typically, the brown fine sandy loam surface layer extends to a depth of about 10 inches. Below this, to a depth of about 18 inches, is dark grayish brown loam. Next are very dark gray loam to a depth of about 23 inches, dark gray clay loam to a depth of 31 inches, and brown mottled clay loam to a depth of 48 inches. The underlying material to a depth of 72 inches is light yellowish brown clay loam mottled with yellowish brown and pale brown.

Included with these soils in mapping are small areas of Wynona soils.

Gowton soils are high in natural fertility and organic matter content. They range from medium acid to neutral in the upper part of the soil and from slightly acid to moderately alkaline in the underlying material. Permeability is moderate, runoff is slow, and available water capacity is high. These soils have good tilth. The root zone is deep and is easily penetrated by plant roots.

The soils in this map unit have very low potential for row crops or small grains because of frequent flooding. They have high potential for hay or tame pasture.

These soils have low potential for urban uses. Flooding is a limitation for most uses and is expensive to overcome.

These soils are in capability subclass Vw and the Loamy Bottomland range site.

15—Gracemont fine sandy loam. This deep, somewhat poorly drained, nearly level soil is on flood plains of the major streams and is frequently flooded. Slopes are plane or slightly undulating. Individual areas are long and narrow along either side of a stream channel and range from 50 to 500 acres.

Typically, the surface layer is reddish brown fine sandy loam about 10 inches thick and has few thin strata of loam and very fine sandy loam. The underlying material to a depth of 80 inches is more stratified.

Included with this soil in mapping, and making up about 5 percent of the mapped area, is soil that is similar, near a stream, and has a water table at a depth of 40 to 60 inches late in winter and in spring. About 10 percent is a soil that is similar to the Gracemont soil but has more clayey strata. This soil is mostly in the lower areas farthest from the channel. About 3 percent is Harjo clay that is along the outer edge of the map unit away from the channel.

This soil is low in natural fertility and organic matter content. It is mildly alkaline or moderately alkaline in the

surface layer and moderately alkaline in the underlying material. Permeability is moderately rapid, runoff is slow, and available water capacity is medium. The apparent water table is at a depth of 1/2 foot to 3 feet during winter and spring.

This soil has very low potential for growing crops. Tame pasture grasses that are water tolerant, such as tall fescue and bermudagrass, grow well.

Potential for urban uses is low. Flooding and the seasonal high water table are limitations for most urban uses and are expensive to overcome.

This soil is in capability subclass Vw and the Subirrigated range site.

16—Gracemore loamy fine sand. This deep, somewhat poorly drained, nearly level soil is on flood plains and is frequently flooded. Individual areas range from about 10 to 100 acres.

Typically, the surface layer is light reddish brown loamy fine sand about 9 inches thick. The underlying material to a depth of 60 inches is pink loamy fine sand with common thin strata of fine sand and fine sandy loam.

Included with this soil in mapping, and making up about 15 percent of the mapped area, are soils that are similar but have a fine sandy loam, loam, or clay loam surface layer. About 10 percent are soils that are also similar to the Gracemore soil but have thin strata of fine sandy loam or have more clayey texture between depths of 10 and 40 inches.

This soil is low in natural fertility and organic matter content. It is mildly alkaline or moderately alkaline in the surface layer and moderately alkaline in the underlying material. Permeability is moderately rapid, runoff is slow, and available water capacity is low. This soil has an apparent water table at a depth of 1/2 foot to 3 feet during winter and spring.

This soil has very low potential for use as cropland. Flooding and a high water table are the chief limitations. This soil has high potential for hay and tame pasture.

This soil has low potential for urban uses. The high water table and flooding are limitations for nearly all urban uses.

This soil is in capability subclass Vw and the Subirrigated range site.

17—Grainola and Aydelotte soils, 3 to 8 percent slopes, severely eroded. This map unit consists of clayey, severely eroded, gently sloping to sloping soils on uplands. The moderately deep, well drained Grainola soils are on foot slopes or in concave areas between areas of the deep, well drained Aydelotte soils on convex ridge crests. These soils are in an irregular pattern. Individual areas of each soil are large enough to map separately, but because of present and predicted use, they were mapped as one unit. Most mapped areas contain both soils, but a few areas contain only one of the soils. On about 60 percent of the acreage, the clayey subsoil is exposed.

These soils are severely eroded. Uncrossable gullies ranging from 1 foot to 5 feet in depth and 50 to 300 feet feet apart are present. Rills are common between the gullies.

About 35 percent of the acreage is Grainola soils, 35 percent is Aydelotte soils, and the remaining 30 percent is Chickasha, Lucien, Seminole, and Stephenville soils.

Typically, the Grainola soils have a reddish brown silty clay loam surface layer 5 inches thick. The upper part of the subsoil is reddish brown silty clay to a depth of 12 inches. The lower part of the subsoil is reddish brown clay to a depth of 30 inches. Below that is reddish brown laminated shale.

These soils are low in natural fertility and organic matter content. They have a mildly alkaline or moderately alkaline surface layer that may or may not be calcareous. The subsoil and underlying shale are moderately alkaline and calcareous. Permeability is slow, runoff is rapid, and available water capacity is medium. These soils are droughty. The root zone is moderately deep, but the subsoil is not easily penetrated by plant roots.

Typically, the Aydelotte soils have a reddish brown clay loam surface layer about 3 inches thick. The subsoil is yellowish red clay to a depth of about 60 inches.

These soils are low in natural fertility and organic matter content. They have a slightly acid or neutral surface layer. They are slightly acid to mildly alkaline in the upper part of the subsoil and are moderately alkaline in the lower part of the subsoil and in the underlying material. Permeability is very slow, runoff is rapid, and available water capacity is high. The root zone is deep, but the subsoil is not easily penetrated by plant roots.

The soils in this map unit have very low potential for use as cropland and other agricultural uses. The original surface layer is thin or eroded away.

The soils in this map unit have medium potential for most urban uses. The high shrink-swell potential and low strength are limitations for dwellings, small commercial buildings, and roads and streets. The slow or very slow permeability of these soils limits their use for septic tank absorption fields. Slope is a limitation for sewage lagoons and some other uses. Most of these limitations can be overcome.

These soils are in capability subclass VIe and the Eroded Clay range site.

18—Grainola-Lucien complex, 3 to 12 percent slopes. This map unit consists of gently sloping to strongly sloping soils on uplands. Most areas are drainageways that have dissected the smooth uplands. The moderately deep, well drained Grainola soils are on side slopes or foot slopes between areas of shallow, well drained Lucien soils on ridges or on the upper parts of slopes. The soils are so intermingled that they are not shown separately on the soil map. They range from 300 to 1,000 feet in width and are more than a mile long. The delineations range from 10 to 500 acres. Individual

areas of each soil range from 1/4 acre to more than 5 acres.

Grainola soils make up about 60 percent of each mapped area. Typically, the surface layer is reddish brown clay loam to a depth of about 4 inches. The subsoil is reddish brown clay to a depth of about 36 inches. The underlying material is reddish brown laminated shale.

The soils are low in natural fertility and organic matter content. They are mildly alkaline or moderately alkaline in the surface layer and moderately alkaline and calcareous in the subsoil and underlying material. Permeability is slow, runoff is rapid, and available water capacity is medium. These soils are droughty. The root zone is moderately deep, but the subsoil is not easily penetrated by plant roots.

Lucien soils make up about 25 percent of each mapped area. Typically, the surface layer is brown loam about 4 inches thick. The subsoil is brown loam to a depth of about 12 inches. The underlying material is soft sandstone.

Lucien soils are medium in natural fertility and organic matter content. They are slightly acid or neutral. Permeability is moderately rapid, runoff is rapid, and available water capacity is low. This soil is droughty. The root zone is shallow and is easily penetrated by plant roots.

The remaining 15 percent of each mapped area consists of Aydelotte, Chickasha, and Seminole soils and soils that are similar to Grainola soils but have a thicker surface layer.

Lucien soils have very low potential for farming and low potential for tame pasture. Yields are low because of the droughtiness of both major soils.

The soils in this complex have low potential for most urban uses. The low strength and high shrink-swell potential of the Grainola soils and the shallow depth to rock of the Lucien soils are the main limitations for small commercial buildings and dwellings. The moderate or shallow depth to rock and the slow permeability of the Grainola soils are limitations for septic tank absorption fields.

These soils are in capability subclass VIe and the Shallow Prairie range site.

19—Harjo clay. This deep, poorly drained, nearly level soil is on flood plains and is frequently flooded. Slopes are slightly concave. Individual areas range from 10 to 200 acres.

Typically, the surface layer is red clay about 9 inches thick. The underlying material to a depth of 60 inches is reddish brown clay stratified with thin strata of loam and very fine sandy loam. Below that, to a depth of 80 inches, it is reddish brown clay loam stratified with thin strata of yellowish red loam, fine sandy loam, and very fine sandy loam.

Included with this soil in mapping, and making up about 20 percent of the mapped area, are Gracemont soils or soils that are similar to Gracemont soils but underlain at a depth of 30 to 60 inches by clay. About 10 percent is a soil that is similar to the Harjo soil but has thick silty strata at a depth of 10 to 40 inches.

This soil is low in natural fertility and organic matter content. The apparent water table is within 1 foot of the surface during most of the year. This soil has very slow permeability, runoff is slow, and available water capacity is high.

This soil has very low potential for use as cropland or pasture. With good surface drainage it is suited to tame pastures and grasses such as bermudagrass and fescue. In many areas it is nearly impossible for gravity flow drains to operate, and where it is possible, maintenance is high because of the frequent flooding.

This soil has low potential for urban uses. Frequent flooding, high shrink-swell potential, and a high water table are limitations for nearly all urban uses.

This soil is in capability subclass VIIw and the Wetland range site.

20—Keokuk silt loam. This deep, well drained, nearly level soil is on flood plains, but it is rarely flooded. Slopes are plane or very slightly convex. Individual areas range from 5 to 500 acres.

Typically, the surface layer is dark grayish brown silt loam about 16 inches thick. The subsoil is brown silt loam to a depth of about 24 inches. The underlying material is pale brown very fine sandy loam to a depth of 60 inches.

Included with this soil in mapping, and making up about 20 percent of the mapped area, are areas that are slightly more sandy. About 5 percent is Asher silty clay loam. Also included, and making up about 1 percent of the map unit, is a soil on the edge of a terrace that has slopes of 8 to 15 percent and ranges from 50 to 75 feet in width.

Keokuk silt loam is high in natural fertility and organic matter content. It is slightly acid or neutral in the surface layer and subsoil and moderately alkaline in the underlying material. Permeability is moderate, runoff is slow, and available water capacity is high. This soil has good tilth and can be worked throughout a moderate range in moisture content. The root zone is deep and is easily penetrated by plant roots.

This soil has high potential for row crops, small grains, hay, and pasture. Plowpans form easily if the soil is plowed when wet. Good tilth is easily maintained by returning crop residue to the soil. Wind erosion is a slight hazard where the soil is bare. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help to reduce wind erosion and to increase water intake.

This soil has medium potential for urban uses. Its chief limitation is rare flooding.

This soil is in capability class I and the Loamy Bottomland range site.

21—Konawa fine sandy loam, 0 to 3 percent slopes. This deep, well drained, nearly level to very

gently sloping soil is on broad ridgetops of uplands (fig. 2). Slopes are plane or convex. Individual areas range from 5 to 200 acres.

Typically, the surface layer is grayish brown fine sandy loam about 5 inches thick. The subsurface layer is light yellowish brown fine sandy loam to a depth of 14 inches. The upper part of the subsoil is yellowish red sandy clay loam to a depth of about 36 inches. The lower part of the subsoil is reddish yellow fine sandy loam to a depth of 60 inches.

Included with this soil in mapping is about 5 percent Dougherty soil and 5 percent soils that are similar but are underlain by clay or sandstone at a depth of 40 to 60 inches.

This soil is low in natural fertility and organic matter content. It is slightly acid or medium acid in the surface layer, except where limed; ranges from medium acid to strongly acid in the subsoil, and from neutral to strongly acid in the underlying material. Permeability is moderate, runoff is slow, and available water capacity is high. The soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

This soil has high potential for row crops, small grains, hay, and tame pasture. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard on the steeper slopes where cultivated crops are grown. Terraces may be needed. Minimum tillage and use of cover crops, including grasses and legumes, help to reduce runoff and to control erosion.

This soil has high potential for urban uses. Low strength is a limitation for local roads and streets, but it can be easily overcome by good design and careful installation. Seepage is a limitation for sewage lagoons and trench sanitary landfills.

This soil is in capability subclass IIe and the Sandy Savannah Range Site.

22—Konawa fine sandy loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on side slopes and ridges of uplands. Slopes are plane and convex. Individual areas range from 5 to more than 200 acres.

Typically, the surface layer is grayish brown fine sandy loam about 4 inches thick. The subsurface layer is light yellowish brown fine sandy loam to a depth of about 16 inches. The upper part of the subsoil is yellowish red sandy clay loam to a depth of about 50 inches. The lower part of the subsoil is reddish yellow fine sandy loam to a depth of 60 inches.

Included with this soil in mapping is a soil that is similar but is somewhat poorly drained and Dougherty soils. Each of these soils makes up about 10 percent of the mapped area. Also included is about 10 percent Konawa loamy fine sand, and about 2 percent is a soil that has 15 to 35 percent content of gravel in the upper part of the subsoil.

This soil is low in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer, except where limed; and below that it ranges from strongly acid to neutral. Permeability is moderate, runoff is medium to rapid, and available water capacity is high. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

This soil has medium potential for row crops and small grains and high potential for hay and tame pasture. Good tilth is maintained by returning crop residue to the soil. Erosion is a hazard where cultivated crops are grown. Terracing is essential, except where the surface layer is loamy fine sand. Minimum tillage, cover crops, and the use of grasses and legumes in the cropping system, help to reduce runoff and to control erosion.

This soil has high potential for most urban uses. Low strength is a limitation for local roads and streets, but it can be easily overcome by good design and careful installation. Seepage is a limitation for sewage lagoons and for trench sanitary landfills.

This soil is in capability subclass IIIe and the Sandy Savannah range site.

23—Konawa fine sandy loam, 2 to 5 percent slopes, eroded. This deep, well drained, very gently sloping to gently sloping eroded soil is on ridges and side slopes of uplands. Slopes are plane and convex. Individual areas range from 5 to more than 300 acres.

Typically, the surface layer is brown fine sandy loam about 7 inches thick. The upper part of the subsoil is red sandy clay loam to a depth of about 30 inches. The middle part of the subsoil is light red sandy clay loam to a depth of about 45 inches. The lower part of the subsoil is light red fine sandy loam to a depth of 72 inches.

Included with this soil in mapping, and making up about 10 percent of the mapped area, are soils that are somewhat poorly drained and are more clayey in the lower part of the subsoil beginning at a depth of 50 to 72 inches. About 5 percent are soils that are similar to the Konawa soil but are more clayey in the subsoil.

This soil is eroded. In most of the area, the original surface and subsurface layers were mixed by cultivation, and the present surface layer ranges from 6 to 10 inches in thickness. In about 25 percent of the area the present surface layer includes what was once the upper part of the subsoil and is now being mixed with each cultivation. Tilth is not as good and permeability is reduced, but production under good management is only slightly reduced.

Natural fertility and organic matter content are low. This soil is slightly acid or medium acid in the surface layer, ranges from medium acid to strongly acid in the subsoil, and from neutral to strongly acid in the underlying material. Permeability is moderate, runoff is rapid, and available water capacity is high. The root zone is deep and is easily penetrated by plant roots.

This soil has low potential for row crops and small grains and medium potential for hay and tame pasture. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard, and terracing is essential where cultivated crops are grown. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help to reduce runoff and to control erosion.

This soil has high potential for most urban uses. Low strength is a limitation for local roads and streets, and seepage is a limitation for sewage lagoons and trench sanitary landfills.

This soil is in capability subclass IIIe and the Sandy Savannah range site.

24—Konawa fine sandy loam, gullied. This deep, well drained, very gently sloping to gently sloping eroded soil is on uplands. Slopes are plane and concave and range from 2 to 5 percent. Individual areas range from 5 to 50 acres.

Typically, the surface layer is pale brown fine sandy loam about 6 inches thick. The upper part of the subsoil is yellowish red sandy clay loam to a depth of about 28 inches. The middle part of the subsoil is reddish yellow sandy clay loam to a depth of about 40 inches. The lower part of the subsoil is reddish yellow fine sandy loam to a depth of 60 inches.

This soil has gullies ranging from 50 to 200 feet apart. These gullies are as much as 20 feet deep, up to 30 feet or more wide, and make up about 5 percent of the map unit. Soils that have a surface layer less than 4 inches thick but are not gullied make up about 35 percent of the map unit. Also included in mapping is about 5 percent Dougherty soils, and 10 percent is a soil that has clay or sandstone at a depth of 40 to 60 inches.

This soil is low in natural fertility and organic matter content. It is slightly acid or medium acid in the surface layer, except where limed, ranges from medium acid to strongly acid in the subsoil, and from neutral to strongly acid in the underlying material. Permeability is moderate, runoff is rapid, and available water capacity is high. The area between the gullies has good tilth, but the exposed subsoil in the gullies has poor tilth. The root zone is deep and is easily penetrated by plant roots.

This soil has very low potential for cropland. Further erosion is a severe hazard. Gullies should be shaped and planted to a permanent cover. This soil has medium potential for permanent hay and tame pasture. Good yields of hay and pasture are obtained with fertilization and good management.

This soil has high potential for most urban uses. The main limitations are low strength for local roads and streets, slope for small commercial buildings, and seepage for sewage lagoons and trench sanitary landfills. Cost of shaping gullies is increased somewhat and erosion can be a severe problem during construction.

This soil is in capability subclass VIe and the Eroded Sandy Savannah range site.

25—Madill fine sandy loam. This deep, well drained, nearly level soil is on flood plains of the smaller streams, mainly in narrow areas along the stream channel. This soil is subject to occasional flooding. Slopes are plane. Individual areas range from 5 to more than 200 acres.

Typically, the surface layer is brown fine sandy loam about 10 inches thick. The underlying material is light brown fine sandy loam to a depth of 42 inches, dark reddish brown loam to a depth of 52 inches, and reddish brown loam to a depth of 60 inches.

Included with this soil in mapping, and making up 10 percent of the mapped area, are Gowton soils that have an overwash of yellowish brown fine sandy loam that is 8 to 20 inches thick. About 5 percent is a soil similar to the Madill soil but is calcareous. About 3 percent is a soil that has a brown surface layer 7 to 10 inches thick.

This soil is low in natural fertility and organic matter content. It is medium acid to neutral to a depth of 40 inches and neutral to moderately alkaline below 40 inches. Permeability is moderately rapid, runoff is slow, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep and easily penetrated by plant roots.

This soil has high potential for row crops, small grains, hay, and tame pasture. Good tilth is maintained by returning crop residue to the soil. Minimum tillage and the use of cover crops help to improve tilth, and water infiltration. This soil has low potential for urban uses because of frequent flooding.

This soil is in capability subclass IIw and the Loamy Bottomland range site.

26—Newtonia-Catoosa complex, 1 to 3 percent slopes. This map unit consists of very gently sloping soils on uplands. The deep, well drained Newtonia soil is in concave areas between areas of the moderately deep, well drained Catoosa soil on ridge crests. The soils are so intermingled that they could not be shown separately on the soil map. They are in narrow bands ranging from 10 to 100 acres. Individual areas of each soil range from 1/4 acre to 4 acres.

Newtonia loam makes up about 40 percent of the mapped area. Typically, the surface layer is reddish brown silt loam about 10 inches thick. The upper part of the subsoil is reddish brown silty clay loam to a depth of about 16 inches. The middle part of the subsoil is yellowish red silty clay loam to a depth of about 52 inches. The lower part of the subsoil is yellowish red sandy clay loam to a depth of about 61 inches. The underlying material is slightly weathered yellowish brown sandstone.

This soil is high in natural fertility and organic matter content. It is slightly acid or neutral in the surface layer and ranges from medium acid to moderately alkaline in the subsoil. Permeability is moderate, runoff is medium, and available water capacity is high.

Catoosa loam makes up about 25 percent of the mapped area. Typically, the surface layer is grayish

brown silt loam about 14 inches thick. The upper part of the subsoil is brown silt loam to a depth of about 22 inches. The lower part of the subsoil is brown silty clay loam to a depth of about 32 inches. The underlying material is light gray, hard limestone.

This soil is high in natural fertility and organic matter content. It is slightly acid or neutral throughout. Permeability and runoff are moderate, and available water capacity is medium.

Included with these soils in mapping, and making up about 15 percent of the mapped area, are soils that are similar to the Catoosa soil but have limestone at a depth of 40 to 60 inches. Another 15 percent of the mapped area is a soil that has a black silty clay loam surface layer and a dark grayish brown silty clay or silty clay loam subsoil that extends to a depth of about 60 inches. This soil is in concave swale areas. Areas of Shidler soils and limestone outcrops make up 5 percent of the mapped area.

The soils in this complex have high potential for row crops, small grains, hay, and tame pasture. They are somewhat limited by the size and irregular shape of the mapped area. Good tilth is maintained by returning crop residue to the soil. Erosion is a moderate hazard where cultivated crops are grown, and terracing is then essential. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help to reduce runoff and to control erosion.

The soils in this complex have medium potential for most urban uses. The generally moderate shrink-swell potential and low strength of the soils are limitations for dwellings, small commercial buildings, and road and streets; but these soil features can be overcome by good design and careful installation procedures. The moderate permeability of the soils and the moderate depth to rock of the Catoosa soil are limitations for septic tank absorption fields but can be overcome by enlarging the area.

These soils are in capability subclass IIe and the Loamy Prairie range site.

27—Niotaze-Darnell complex, 8 to 30 percent slopes. This map unit consists of strongly sloping to steep soils on uplands. The moderately deep, somewhat poorly drained Niotaze soil is on side slopes between areas of the shallow, well drained Darnell soil on ridge crests and side slopes. The soils are so intermingled that they are not shown separately on the soil map. They are in areas ranging from 100 to over 600 feet in width, averaging about 300 feet, and are continuous in length for 1 mile to 3 miles (fig. 3). Individual areas of each soil range from 5 to 100 feet in width and 1/4 acre to 10 acres in size.

Niotaze stony fine sandy loam and closely related soils make up about 55 percent of the map unit. Typically, the surface layer is brown stony fine sandy loam about 5 inches thick. The subsurface layer is light yellowish brown stony fine sandy loam to a depth of about 10 inches. The upper part of the subsoil is light yellowish brown clay mottled with grayish brown and gray to a depth of about 22 inches. The lower part of the subsoil is pale brown clay mottled with grayish brown and gray to a depth of about 32 inches. The underlying material is weakly laminated shale.

The Niotaze soil is low in natural fertility and organic matter content. It is strongly acid or medium acid in the surface layer and subsurface layer and ranges from slightly acid to strongly acid in the subsoil. Permeability is slow, runoff is rapid, and available water capacity is medium. This soil has a perched water table at a depth of 1 foot to 2 feet during winter and spring.

Darnell stony fine sandy loam and related soils, including sandstone outcrops, make up about 45 percent of the map unit. Typically, the Darnell soil has a grayish brown stony fine sandy loam surface layer about 4 inches thick. The subsoil is light yellowish brown fine sandy loam to a depth of about 12 inches. The underlying material is soft sandstone.

The Darnell soil is low in natural fertility and organic matter content. It ranges from medium acid to neutral in the surface layer and strongly acid to neutral in the subsoil. Permeability is moderately rapid, runoff is rapid, and available water capacity is low.

The soils in this complex have very low potential for agricultural uses. The shallow areas and steep slopes are the main limitations. Some areas were cleared of brush and planted to tame pasture. Yields are low unless moderate to heavy amounts of fertilizer are applied.

The soils in this complex have low potential for urban uses. The steep slopes and the moderate to shallow depth to bedrock are limitations for most urban uses.

These soils are in capability subclass VIIs. The Niotaze soil is in the Sandy Savannah range site, and the Darnell soil is in the Shallow Savannah range site.

28—Niotaze-Wewoka complex, 3 to 12 percent slopes. This map unit is made up of gently sloping to strongly sloping soils on uplands. The moderately deep, somewhat poorly drained Niotaze soil is on slide slopes between areas of the moderately deep, somewhat excessively drained Wewoka soil on ridge crests. The soils are so intermingled that they are not shown separately on the soil map. They are in an area ranging from 40 to 2,000 acres. Individual areas of each soil range from 1/4 acre to 10 acres. The larger areas are long and narrow.

Niotaze fine sandy loam makes up about 50 percent of each mapped area. Typically, the surface layer is brown, fine sandy loam about 6 inches thick. The subsurface layer is light yellowish brown, fine sandy loam to a depth of about 10 inches. The upper part of the subsoil, to a depth of about 22 inches, is light yellowish brown clay with gray mottles, and the lower part of the subsoil is pale brown clay with gray mottles to a depth of about 32 inches. The underlying material is shale.

This soil is low in natural fertility and organic matter. It is medium acid or strongly acid in the surface layer and subsurface layer and ranges from slightly acid to strongly acid in the subsoil. Permeability is slow, runoff is rapid, and available water capacity is medium. This soil is somewhat poorly drained. It has a perched water table at a depth of 1 foot to 2 feet during winter and spring.

Wewoka gravelly sandy loam makes up about 35 percent of each mapped area. Typically, the surface layer is

brown gravelly sandy loam 5 inches thick. The subsurface layer is pink gravelly loamy sand to a depth of 17 inches. The subsoil is reddish yellow, very gravelly loamy sand to a depth of about 22 inches. The underlying material is reddish yellow cherty conglomerate.

This soil is low in natural fertility and organic matter content. Permeability is moderately rapid, runoff is rapid, and available water capacity is low. This soil ranges from neutral to very strongly acid throughout.

The remaining 15 percent of this map unit is made up of Darnell and Stephenville soils.

This map unit has very low potential for use as cropland. It has a severe erosion hazard where field crops are grown. It has medium potential for hay and tame pasture. Proper grazing, controlling brush, and preventing fires help to maintain or improve the grass and to control erosion.

This map unit has low potential for most urban uses. The moderate depth to rock is the main soil feature to consider where these soils are used for septic tank absorption fields or sewage lagoons. The high shrink-swell potential and wetness of the Niotaze soils are the main limitations for dwellings or small commercial buildings.

These soils are in capability subclass VIe. The Niotaze soil is in the Sandy Savannah range site, and the Wewoka soil is in the Shallow Savannah range site.

29—Oil-waste land. This map unit is made up of areas of oil and salt water wastes that are in connection with oil drilling or refining operations. The areas are usually about 2 to 5 acres in size but range from 1/2 acre to 30 acres. Slopes range from 0 to 10 percent. Surface runoff is rapid, and erosion is a severe hazard.

Oil-waste land is unsuitable for farming. Some of it can be reclaimed, but the cost is high. Diversion of surface drainage from higher areas is necessary. Rainwater can be impounded to help leach out soluble salts. A mulch of hay or straw reduces evaporation and helps to prevent accumulation of salts on the surface.

Very little vegetation grows on these areas. Salt-tolerant pasture plants can be grown if planted in the middle of the rainy season, when the salt accumulations on the surface are reduced.

This miscellaneous area is in capability subclass VIIIs and is not assigned to a range site.

30—Okemah silt loam, 0 to 1 percent slopes. This deep, moderately well drained, nearly level, upland soil is on broad flats. Slopes are plane and very slightly concave. Individual areas range from 5 to 100 acres.

Typically, the surface layer is dark gray silt loam about 15 inches thick. The upper part of the subsoil is dark gray silty clay loam to a depth of about 20 inches. The middle part of the subsoil is dark grayish brown clay with mottles of dark yellowish brown to a depth of about 36 inches and grayish brown silty clay with mottles of light brownish gray and yellowish brown to a depth of about 60 inches. The lower part of the subsoil is light yellowish brown silty clay with mottles of yellowish brown, light brownish gray, and light gray to a depth of 80 inches.

Included with this soil in mapping, and making up about 30 percent of the mapped area, are soils that are similar but are not as wet. Also included is about 15 percent soils that do not have grayish mottles but do have bright mottles in the lower part of the subsoil.

This soil is high in natural fertility and organic matter content. The surface layer ranges from slightly acid to mildly alkaline, the upper part of the subsoil ranges from medium acid to neutral, and the lower part of the subsoil ranges from neutral to moderately alkaline. Permeability and runoff are slow, and the available water capacity is high. This soil generally has good tilth, but it is somewhat slow to dry sufficiently to be worked. The root zone is deep. This soil has a perched water table at a depth of 2 to 3 feet during winter and spring.

This soil has high potential for growing all adapted crops. Good tilth is maintained by returning crop residue to the soil and by refraining from cultivation when the soil is wet. Minimum tillage and the use of cover crops in the cropping system help to reduce runoff and to control erosion.

This soil has medium potential for urban uses. High shrink-swell potential and low strength are limitations for dwellings and small commercial buildings, but these limitations can be overcome by careful design. Slow permeability is the main limitation for septic tank absorption fields. The use of septic tank absorption fields is not satisfactory unless extensive and costly alteration of the soil is made. It is usually best to use another method of waste disposal, such as sewage lagoons.

This soil is in capability class I and the Loamy Prairie range site.

31—Okemah silt loam, 1 to 3 percent slopes. This deep, moderately well drained, very gently sloping soil is on uplands. Slopes are plane or convex. Individual areas range from 5 to more than 500 acres. This soil is largely in the eastern one-third of the county.

Typically, the surface layer is black silt loam about 18 inches thick. The upper part of the subsoil, to a depth of about 24 inches, is very dark grayish brown silty clay loam. The middle part of the subsoil is dark grayish brown silty clay loam and dark grayish brown clay that has dark yellowish brown, brown, and dark gray mottles to a depth of about 50 inches. The lower part of the subsoil is coarsely mottled yellowish brown, gray, and light brownish gray clay to a depth of 72 inches.

Included with this soil in mapping are soils that are similar but have a thinner surface layer; calcium carbonate in the subsoil at a depth below 36 inches; shale, siltstone, or sandstone below a depth of 50 inches; or no mottles in the subsoil at a depth of less than 50 inches. Also included in mapping are small areas of Dennis loam and Carytown silt loam. Total inclusions make up about 50 percent of this map unit.

Natural fertility and organic matter content are high. This soil ranges from slightly acid to mildly alkaline in the surface layer and grades to moderately alkaline in the lower part of the subsoil. Permeability is slow, runoff is moderate, and available water capacity is high. This soil has good tilth, but tillage is delayed because the soil is somewhat slow to dry sufficiently to be worked. The root zone is deep. This soil has a perched water table at a depth of 2 to 3 feet during winter and spring.

This soil has high potential for growing row crops, small grains, hay, and pasture. Good tilth and fertility are easily maintained by returning crop residue to the soil and by adding fertilizer. The hazard of erosion is moderate where cultivated crops are grown. Terracing is essential to prevent excessive soil loss. Minimum tillage and cover crops help to reduce runoff and to control erosion.

This soil has medium potential for urban uses. High shrink-swell potential and low strength are limitations for dwellings and small commercial buildings but can be overcome by careful design. Slow permeability is the main limitation for septic tank absorption fields. The use of septic tank absorption fields is not satisfactory unless extensive and costly alteration of the soil is made. It is usually best to use another method of waste disposal, such as sewage lagoons.

This soil is in capability subclass IIe and the Loamy Prairie range site.

32—Okemah-Carytown complex, 0 to 2 percent slopes. This map unit is made up of nearly level to very gently sloping soils on uplands. The deep, moderately well drained Okemah soil is on convex slopes between areas of the deep, poorly drained Carytown soil, which is in concave or depressional areas. The soils are so intermingled that they are not shown separately on the soil map. They are in bands about 500 feet wide ranging from 10 to 100 acres on concave toe slopes. Individual areas of each soil range from 1/4 acre to 4 acres.

Okemah silt loam makes up about 50 percent of each mapped area. Typically, the surface layer is dark gray silt loam about 16 inches thick. The upper part of the subsoil is dark gray silty clay loam to a depth of about 22 inches. The middle part of the subsoil is mottled, dark gray silty clay to a depth of about 50 inches. The lower part of the subsoil is mottled, dark grayish brown silty clay to a depth of about 80 inches.

This soil is high in natural fertility and organic matter. It ranges from slightly acid to mildly alkaline in the surface layer and becomes moderately alkaline in the lower part of the subsoil. Permeability and runoff are slow, and available water capacity is high. This soil has a perched water table at a depth of 2 to 3 feet during winter and spring.

Carytown silt loam makes up about 20 percent of each mapped area. Typically, the surface layer is light brownish gray silt loam about 6 inches thick. The upper part of the subsoil, high in sodium content, is grayish brown mottled silty clay loam and silty clay to a depth of about 35 inches. The middle part of the subsoil is light brownish gray mottled silty clay to a depth of about 50 inches. The lower part of the subsoil is light yellowish brown mottled silty clay to a depth of 72 inches.

This soil is low in natural fertility and organic matter content. Permeability is very slow, runoff is slow, and available water capacity is medium. This soil ranges from slightly acid to mildly alkaline in the surface layer, neutral to moderately alkaline in the upper part of the subsoil, and it is moderately alkaline below. It has a water table within 1 foot of the surface during winter and spring.

Included with this complex in mapping, and making up about 10 percent of the mapped area, are soils that are similar to the Carytown soil but have a thicker surface layer. Dennis soils make up about 15 percent and Bates soils make up about 5 percent of the mapped area.

The soils in this complex have low potential for use as cropland. They have medium potential for hay and tame pasture. The soils have low potential for most urban uses. The high shrink-swell potential, high sodium content, low strength, and slow to very slow permeability of the soils are limitations that are difficult and costly to overcome.

These soils are in capability subclass IIIe. The Okemah soil is in the Loamy Prairie range site, and the Carytown soil is in the Shallow Claypan range site.

33—Pits. These areas are open excavations from which soil and underlying material have been removed. There are several kinds of pits in the county, such as borrow pits, gravel pits, quarries, and sand pits. Gravel pits are most common. They are areas where gravelly soils have been removed for road building material, leaving a hard sandstone or sandstone conglomerate exposed. Other kinds of pits have variable underlying bedrock, such as shale, sandstone, or limestone. Many have areas that hold water. Pits support little or no vegetation. In the sand pits and quarries, some overburden materials are stockpiled. These materials would support vegetation if they were shaped and planted.

These areas are not assigned to a capability subclass or range site.

34—Prue loam, 1 to 3 percent slopes. This deep, moderately well drained, very gently sloping soil is on foot slopes of uplands (fig. 4). Slopes are plane or convex. Individual areas range from 5 to more than 300 acres.

Typically, the surface layer is dark gray loam about 18 inches thick. The upper part of the subsoil is grayish brown clay loam to a depth of 24 inches. The middle part of the subsoil is mottled, grayish brown clay loam to a depth of about 36 inches and mottled, grayish brown clay to a depth of about 50 inches. The lower part of the subsoil is coarsely mottled, light yellowish brown, light gray, and light brownish yellow clay to a depth of about 72 inches.

Included with this soil in mapping are about 5 percent soils that are similar but have shale, siltstone, or sandstone at a depth of less than 50 inches. Carytown soils make up 5 percent of the map unit. Also included, and making up to 30 percent of the mapped area, are soils that are similar to Prue loam but have clay texture higher in the subsoil.

This soil is medium in natural fertility and organic matter content. It ranges from medium acid to neutral in the surface layer and grades to moderately alkaline in the lower part of the subsoil. Permeability is moderately slow, runoff is medium, and available water capacity is high. This soil has good tilth, but tillage is delayed because the soil is slow to dry sufficiently to be worked. The root zone is deep, but root growth is restricted in the lower part of the subsoil.

This soil has high potential for growing row crops, small grains, hay, and tame pasture. Good tilth and fertility are easily maintained by returning crop residue to the soil and by adding fertilizer. Erosion is a moderate hazard on cropland. Terracing is essential to prevent excessive soil loss. Minimum tillage and cover crops help to reduce runoff and to control erosion.

This soil has medium potential for urban uses. The low strength and high shrink-swell potential are the main limitations for foundations of dwellings and small commercial buildings. These limitations can be overcome by special design and very careful installation. The moderately slow permeability is the main limitation for septic tank absorption fields. This can be overcome by increasing the size of the absorption area or by modifying the filter field. Sewage lagoons are an alternative method of effluent disposal which should be considered on this soil.

This soil is in capability subclass IIe and the Loamy Prairie range site.

35—Prue loam, 3 to 5 percent slopes. This is a deep, moderately well drained, gently sloping soil on foot slopes of uplands. Slopes are plane, convex, and concave. Individual areas range from 5 to 500 acres.

Typically, the surface layer is dark grayish brown loam about 20 inches thick. The upper part of the subsoil is dark grayish brown loam to a depth of about 30 inches. The middle part of the subsoil is mottled, brown clay loam to a depth of about 44 inches. The lower part of the subsoil is mottled, light yellowish brown clay to a depth of 72 inches.

Included with this soil in mapping, and making up about 30 percent of the mapped area, are soils that are similar but have more clay in the upper part of the subsoil. Soils with gray mottles in the upper part of the subsoil make up about 5 percent, and in another 5 percent shale is at a depth of 40 to 72 inches. Carytown soils also make up about 5 percent of the mapped area.

This soil is medium in natural fertility and organic matter content. It ranges from medium acid to neutral in the surface layer and generally strongly acid to neutral in the subsoil. In places, it is moderately alkaline in the lower part of the subsoil. Permeability is moderately slow, runoff is rapid, and available water capacity is high. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep, but root growth is restricted in the lower part of the subsoil.

This soil has medium potential for growing row crops and small grains. It has high potential for tame pasture and hay. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard on cropland, and where it is excessive, terracing is essential to prevent it. Minimum tillage and use of cover crops, including grasses and legumes in the cropping system, help to reduce runoff and to control erosion.

This soil has medium potential for urban uses. The high shrink-swell potential and low strength are the main limitations for dwellings and small commercial buildings, but these limitations can be overcome by special design and careful installation procedures. The moderately slow permeability is a limitation for septic tank absorption fields, but this can be overcome by increasing the size of the absorption area or by modifying the filter field.

This soil is in capability subclass IIIe and the Loamy Prairie range site.

36—Roebuck clay. This deep, somewhat poorly drained, nearly level soil is on flood plains of the small streams that occasionally flood. Slopes are plane or slightly concave. Individual areas range from 5 to 300 acres.

Typically, the surface layer is reddish brown clay to a depth of about 7 inches and dark reddish gray clay to a depth of about 24 inches. The subsoil is dark reddish gray mottled clay to a depth of about 44 inches. The underlying material is dark reddish gray clay to a depth of 60 inches.

Included with this soil in mapping, and making up about 15 percent of the mapped area, is a soil that is similar but is less red and is moderately well drained. About 10 percent is a soil that is similar to the Roebuck soil but is poorly drained. Wynona soils make up 10 percent, and another 10 percent of the mapped area is frequently flooded.

This soil is high in natural fertility and organic matter content. It is neutral or mildly alkaline in the surface layer, ranges from slightly acid to moderately alkaline in the subsoil, and is moderately alkaline in the underlying material. Permeability is very slow, runoff is slow, and available water capacity is high. This soil is difficult to cultivate. The root zone is deep, but roots penetrate it with some difficulty.

This soil has medium potential for row crops and small grains. Potential is limited by the narrow range in moisture content and the flooding hazard. This soil has high potential for hay and tame pasture. Minimum tillage, especially when the soil is wet, use of cover crops, and returning crop residue to the soil help to maintain tilth.

This soil has low potential for urban uses. Flooding is a limitation that is difficult to overcome for most urban uses. High shrink-swell potential, low strength, and very slow permeability are additional limitations.

This soil is in capability subclass IIIw and the Heavy Bottomland range site.

37—Seminole loam, 1 to 3 percent slopes. This deep, moderately well drained, very gently sloping soil is on prairie uplands. Slopes are plane to slightly concave. Individual areas range from 5 to 150 acres.

Typically, the surface layer is grayish brown loam about 12 inches thick. The upper part of the subsoil is grayish brown mottled loam to a depth of about 16 inches. The middle part of the subsoil is brown mottled clay to a depth of 28 inches and light brownish yellow mottled clay to a depth of 40 inches. The lower part of the subsoil is light brown mottled clay to a depth of about 72 inches.

Included with this soil in mapping, and making up about 30 percent of the mapped area, is a soil that is similar but does not have the high content of sodium in the subsoil, has high shrink-swell potential in the upper part of the subsoil, and has a thinner surface layer. Also included is about 4 percent Chickasha soils, 2 percent Waurika soils, and 2 percent Aydelotte soils.

This Seminole soil is medium in natural fertility and organic matter content. It ranges from medium acid to neutral in the surface layer and upper part of the subsoil and is moderately alkaline below. Permeability is slow, runoff is moderate, and available water capacity is medium. This soil has good tilth, and the root zone is deep. It has a perched water table at a depth of 1 to 2 feet during winter and spring.

This soil has medium potential for most agricultural uses. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard where the soil is cultivated. Terracing is essential where cultivated crops are grown. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help to reduce runoff and to control erosion. Piping is a severe hazard where the subsoil material is used for embankments, dikes, and levees. When this soil is used for borrow material and left exposed, the subsoil and the underlying material seal over, permitting very little rainfall to penetrate.

This soil has medium potential for most urban uses. The high shrink-swell potential and low strength are limitations for dwellings and small commercial buildings and for roads and streets. These limitations can be overcome by good design and careful installation procedures. Slow permeability and wetness are the main limitations for septic tank absorption fields but can be overcome by increasing the size of the absorption field or modifying the filter field. The high content of sodium in the subsoil is a limitation for embankments.

This soil is in capability subclass IIe and the Loamy Prairie range site.

38—Seminole loam, 2 to 5 percent slopes, eroded. This deep, moderately well drained, very gently sloping to gently sloping, eroded soil is on uplands. Slopes are plane to slightly concave. The present plow layer over much of the area consists of part of the original surface layer mixed with material from the subsoil. The surface layer is less friable, lower in organic matter content and fertility. This soil is more difficult to keep in good tilth than the less eroded Seminole soils.

Typically, the surface layer is brown loam about 5 inches thick. The upper part of the subsoil is brown mottled clay to a depth of about 16 inches. The middle part of the subsoil is yellowish brown mottled clay to a depth of about 41 inches. The lower part of the subsoil is light yellowish brown mottled clay to a depth of 60 inches.

Included with this soil in mapping, and making up about 30 percent of the mapped area, is a soil that is similar but does not have sodium in the subsoil and has high shrink swell potential in the upper part of the subsoil. Also included is about 5 percent Chickasha soils, 3 percent Waurika soils, and 3 percent Aydelotte soils.

This Seminole soil is low in natural fertility and organic matter content. It ranges from medium acid to neutral in the surface layer and upper part of the subsoil and from medium acid to moderately alkaline below. Permeability is slow, runoff is rapid, and available water capacity is medium. This soil has good tilth, and the root zone is deep. This soil has a perched water table at a depth of 1 foot to 2 feet during winter and spring.

This soil has medium potential for most agricultural uses. Yields are somewhat reduced because of the thinner surface layer and high sodium content. Tilth can be improved by returning crop residue to the soil. Further erosion is a severe hazard where the soil is cultivated. Terracing is essential where cultivated crops are grown. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help to reduce runoff and to control erosion. Piping is a severe hazard when the subsoil material is used for embankments, dikes, and levees. When this soil is used for borrow material and left exposed, the subsoil and underlying material seal over, permitting very little rainfall to penetrate.

This soil has medium potential for most urban uses. High shrink-swell potential and low strength are the main limitations for dwellings and small commercial buildings and for roads and streets. These limitations can be overcome by good design and careful installation. Slow permeability and wetness are the main limitations for septic tank absorption fields, but these can be overcome by increasing the size of the absorption area or by modifying the filter field. The sodium content of the subsoil is the main concern for embankments.

This soil is in capability subclass IIIe and the Loamy Prairie range site.

39—Seminole, Chickasha, and Prue soils, 2 to 8 percent slopes, severely eroded. This map unit consists of very gently sloping to sloping, severely eroded soils on uplands (fig. 5). Individual areas of these soils are large enough to map separately, but because of present and predicted use, and similar response to use and management, they are not shown separately on the soil map. Many areas contain only one of these soils. The Prue soils are limited to the eastern one-third of the county, while the Seminole and Chickasha soils are in the western part of the county.

This map unit consists of about 40 percent Seminole soils, 30 percent Chickasha soils, 15 percent Prue soils, 5 percent gullies and soils that are similar to the Seminole, Chickasha, or Prue soils, except the original surface layer has been completely eroded and the subsoil is exposed. The remaining 10 percent consists of Aydelotte, Bates, Coweta, and Teller soils between gullies. The gullies range from 50 to 300 feet apart, 2 to 10 feet in depth, and 2 to 30 feet in width.

Typically, the Seminole soils have a dark grayish brown loam surface layer about 7 inches thick. The upper part of the subsoil is brown mottled clay to a depth of about 17 inches. The lower part of the subsoil is yellowish brown mottled clay to a depth of 60 inches.

These Seminole soils are low in natural fertility and organic matter content. They range from medium acid to neutral in the surface layer and upper part of the subsoil and from medium acid to moderately alkaline below. Permeability is slow, runoff is rapid, and available water capacity is medium. These soils have a perched water table at a depth of 1 foot to 2 feet during winter and spring.

Typically, the Chickasha soils have a grayish brown loam surface layer about 8 inches thick. The upper part of the subsoil is dark yellowish brown sandy clay to a

depth of about 17 inches. The lower part of the subsoil is yellowish brown mottled sandy clay loam to a depth of about 58 inches. The underlying material is yellowish brown soft sandstone.

These Chickasha soils are low in natural fertility and organic matter content. They are medium acid or slightly acid in the surface layer and the upper part of the subsoil and range from slightly acid to moderately alkaline in the lower part of the subsoil. Permeability is moderate, runoff is rapid, and available water capacity is high.

Typically, the Prue soils have a dark grayish brown loam surface layer about 7 inches thick. The upper part of the subsoil, to a depth of about 21 inches, is brown clay loam. The middle part of the subsoil, to a depth of about 33 inches, is light yellowish brown clay loam with many brown mottles. The lower part of the subsoil, to a depth of 60 inches, is light yellowish brown silty clay with many coarse gray, brown, and yellow mottles.

These Prue soils are low in natural fertility and organic matter content. They range from medium acid to neutral in the surface layer and medium acid to moderately alkaline in the lower part of the subsoil. Permeability is moderately slow, runoff is rapid, and available water capacity is high.

The soils in this map unit have very low potential for row crops and small grains and have medium potential for hay and tame pasture. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a severe hazard where cultivated crops are grown. Terracing is essential. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help to reduce runoff and to control erosion.

The soils in this map unit have medium potential for most urban uses. The high shrink-swell potential and low strength of the Prue and Seminole soils are the main limitations for dwellings and small commercial buildings and for roads and streets. These limitations can be overcome by good design and careful installation. The moderately slow permeability of the Prue soils and the slow permeability of the Seminole soils are the main limitations for septic tank absorption fields. These limitations can be overcome by increasing the size of the absorption area or by modifying the filter field.

These soils are in capability subclass VIe and the Eroded Prairie range site.

40—Seminole-Gowton complex, 0 to 12 percent slopes. This map unit is made up of nearly level to strongly sloping soils in narrow drainageways. The Seminole soil is on side slopes. The Gowton soil is on the floor of the drainageway, on flood plains, and is frequently flooded. These soils are so intermingled that they are not shown separately on the soil map. Individual areas of each soil range from 1/4 acre to 10 acres.

Seminole loam makes up about 35 percent of the mapped area. Typically, it has a brown loam surface layer about 5 inches thick. The upper part of the subsoil is brown clay loam to a depth of about 8 inches. The middle part of the subsoil is brown clay to a depth of about 18 inches, yellowish brown clay to a depth of about 28 inches, and brownish yellow clay to a depth of about 36 inches. The lower part of the subsoil, to a depth of 60 inches, is coarsely mottled yellowish brown, brownish yellow, and brownish gray clay with fragments of slightly weathered shale increasing in size and number with depth.

This soil is medium in fertility and organic matter content. It ranges from medium acid to neutral in the surface layer and upper part of the subsoil and from medium acid to moderately alkaline below. Permeability is slow, runoff is rapid, and available water capacity is high. This soil has a perched water table at a depth of 1 to 2 feet during winter and spring.

Gowton loam makes up about 30 percent of the mapped area. Typically, the grayish brown loam surface layer extends to a depth of about 18 inches. Below this is yellowish brown loam to a depth of about 40 inches. The underlying material tc a depth of 60 inches is light yellowish brown loam that has a few thin layers of finer or coarser textures.

This soil is high in natural fertility and organic matter content. It ranges from medium acid to neutral in the surface layer and medium acid to moderately alkaline below. Permeability is moderate, runoff is slow, and available water capacity is high.

Other soils that make up about 35 percent of the map unit include soils that are similar to the Prue soil but have a thinner surface layer, and they are the dominant soils on the side slopes in the eastern one-third of the county. Other soils on the side slopes are loamy to clayey, shallow to deep, and over sandstone or shale. Some deep, loamy soils are on toe slopes. Also included are alluvial soils that are more sandy in texture than the Gowton soil and have a pale brown surface layer. These soils are on flood plains.

The soils in this complex have very low potential for use as cropland. Erosion on side slopes and frequent flooding on flood plains are severe hazards that are difficult to overcome. These soils have medium potential for tame pasture and hay.

The soils in this complex have low potential for most urban uses. Most soils on the side slopes have a high shrink-swell potential and low strength, which are the main limitations for dwellings, small commercial buildings, and roads and streets. These limitations, in conjunction with the narrow side slopes, are difficult to overcome.

Flooding on the soils that are on flood plains is the main limitation for most urban uses. The flood plains are natural drainageways and generally should be left to function as such.

These soils have medium potential for wildlife and for recreational uses, such as picnic areas, paths, and trails.

These soils are in capability subclass VIe. The Seminole soil is in the Loamy Prairie range site, and the Gowton soil is in the Loamy Bottomland range site.

41—Shidler-Rock outcrop complex, 1 to 5 percent slopes. This map unit is made up of shallow and very shallow, very gently sloping to gently sloping soils and areas of Rock outcrop on uplands. The Shidler soil is on crests. The Rock outcrop consists of outcroppings of limestone on crests and between areas of the Shidler

soil. The Shidler soil and Rock outcrop are so intermingled that they are not shown separately on the soil map. Areas range from 20 to more than 100 acres. Individual areas range from a few square feet to more than 4 acres.

Shidler silt loam makes up about 50 percent of the map unit. Typically, the surface layer is dark grayish brown silt loam to a depth of about 7 inches and brown silt loam to a depth of about 18 inches. Below that is hard, light gray limestone.

This soil is high in natural fertility and organic matter content. It ranges from neutral to moderately alkaline. Permeability is moderate, runoff is medium to rapid, and available water capacity is low.

Limestone outcrops make up about 20 percent of the mapped area, and individual outcrops range from 2 to 10 feet in width.

Included with this complex in mapping is about 10 percent brown loam less than 4 inches thick over limestone. Also included are Catoosa soils, soils that are similar to the Catoosa soils but are 10 to 20 inches deep to limestone or 40 to 60 inches deep, and soils that are similar to the Shidler soils but have 35 to 50 percent limestone fragments in the surface layer. These inclusions total about 20 percent of the mapped area.

The soils in this complex have very low potential for agricultural uses. Because of rock outcrops, these soils are not suitable for cultivation. They are best used as rangeland. Areas that have few outcrops could be used for improved pasture.

Potential for urban use is low. The shallow and very shallow depth to bedrock and the presence of areas of Rock outcrop are the main limitations for most urban uses.

The Shidler soil is in capability subclass VIIs and the Very Shallow range site. Rock outcrop is not assigned to a capability subclass.

42—Stephenville fine sandy loam, 1 to 3 percent slopes. This moderately deep, well drained, very gently sloping soil is on upland ridges and slopes. Slopes are plane and convex. Individual areas range from 5 to 100 acres.

Typically, the surface layer is light brownish gray fine sandy loam about 5 inches thick. The subsurface layer is pinkish gray fine sandy loam to a depth of about 14 inches. The upper part of the subsoil is reddish yellow sandy clay loam to a depth of about 24 inches. The lower part of the subsoil is coarsely mottled sandy clay loam in shades of red, brown, and yellow to a depth of about 34 inches. The underlying material is yellowish brown sandstone.

Included with this soil in mapping, and making up about 25 percent of the mapped area, are soils that are similar but have sandstone at a depth of 40 to 60 inches. About 5 percent of the soils are sandy clay in the upper part of the subsoil. Soils that are similar to the Stephenville soil but have sandstone at a depth of 15 to 20 inches make up about 5 percent of this map unit.

This soil is low in natural fertility and organic matter content. It ranges from strongly acid to slightly acid in the surface layer and subsurface layer and from strongly acid to medium acid in the subsoil. Permeability is moderate, runoff is medium, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

This soil has medium potential for row crops and small grains. Low fertility and low organic matter content are limitations that can be overcome by adding fertilizer and by returning crop residue to the soil. This soil has high potential for hay and tame pasture. Good tilth can be maintained by returning crop residue to the soil. Erosion is a moderate hazard where cultivated crops are grown. Terracing is essential. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help to reduce runoff and to control erosion.

This soil has medium potential for most urban uses. The moderate depth to sandstone is the main limitation for septic tank absorption fields. This limitation can be overcome by selecting an area of deeper soils, by increasing the size of the field, or by modifying the filter field. The moderate depth to rock is also the main limitation for sewage lagoons, trench sanitary landfills, and dwellings with basements. Low strength is the main limitation for roads and streets but can be overcome with good design and careful installation.

This soil is in capability subclass IIe and the Sandy Savannah range site.

43—Stephenville fine sandy loam, 3 to 5 percent slopes. This moderately deep, well drained, gently sloping soil is on upland slopes and ridges. Slopes are plane to convex. Individual areas range from 5 to more than 200 acres.

Typically, the surface layer is very pale brown fine sandy loam about 7 inches thick. The upper part of the subsoil is reddish yellow sandy clay loam to a depth of about 28 inches. The lower part of the subsoil is coarsely mottled sandy clay loam in shades of red, brown, and yellow to a depth of about 36 inches. The underlying material is slightly weathered yellowish brown sandstone.

Included with this soil in mapping, and making up about 20 percent of the mapped area, is a soil that is similar but has sandstone at a depth of 40 to 60 inches. Also included is 10 percent Niotaze and Darnell soils.

This soil is low in natural fertility and organic matter content. It ranges from strongly acid to slightly acid in the surface layer and subsurface layer and from strongly acid to medium acid in the subsoil. Permeability is moderate, runoff is rapid, and available water capacity is medium. The soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

This soil has medium potential for row crops and small grains. Low fertility and low organic matter are limitations that can be overcome by adding fertilizer and by returning crop residue to the soil. This soil has high potential for hay and tame pasture. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a severe hazard where cultivated crops are grown. Terracing is essential. Minimum tillage and use of cover crops, in-

cluding grasses and legumes in the cropping system, help to reduce runoff and to control erosion.

This soil has medium potential for most urban uses. The moderate depth to sandstone is the main limitation for septic tank absorption fields. This limitation can be overcome by selecting an area of deeper soils, by increasing the size of the field, or by modifying the filter field. The moderate depth to rock is the main limitation for sewage lagoons, trench sanitary landfills, and dwellings with basements. Low strength is the main limitation for roads and streets, but this can be overcome with good design and careful installation.

This soil is in capability subclass IIIe and the Sandy Savannah range site.

44—Stephenville-Darnell complex, 3 to 12 percent slopes. This map unit consists of gently sloping to strongly sloping soils on uplands. The moderately deep Stephenville soil is on side slopes between areas of the shallow Darnell soil on ridge crests and side slopes. These soils are so intermingled that they are not shown separately on the soil map. They are in areas ranging from 10 to several hundred acres. Individual areas of each soil range from 1/4 acre to 4 acres.

Stephenville fine sandy loam makes up about 40 percent of each mapped area. Typically, the surface layer is grayish brown fine sandy loam about 5 inches thick. The subsurface layer is light brown fine sandy loam to a depth of about 12 inches. The upper part of the subsoil is strong brown sandy clay loam to a depth of about 20 inches. The lower part of the subsoil is reddish yellow sandy clay loam with reddish and brownish mottles to a depth of about 26 inches. The underlying material is yellowish brown sandstone.

This soil is low in fertility and organic matter content. The surface layer and subsurface layer range from strongly acid to slightly acid, but they may be neutral where limed. The subsoil is strongly acid to medium acid. Permeability is moderate, runoff is rapid, and available water capacity is medium.

Darnell fine sandy loam makes up about 35 percent of each mapped area. Typically, the surface layer is pale brown fine sandy loam about 7 inches thick. The upper part of the subsoil is light brown fine sandy loam to a depth of about 12 inches. The lower part of the subsoil is pink fine sandy loam to a depth of about 18 inches. The underlying material is yellowish brown sandstone.

This soil is low in natural fertility and organic matter content. It ranges from medium acid to neutral in the surface layer and strongly acid to neutral in the subsoil. Permeability is moderately rapid, runoff is rapid, and available water capacity is low.

Included with these soils in mapping is about 25 percent other soils and minor extents of Konawa, Eram, and Wewoka soils. Some areas have up to 25 percent Niotaze soils.

The soils in this complex have very low potential for row crops or small grains. The shallow Darnell soil is droughty, and this significantly reduces crop yields. The soils in this complex have medium potential for hay and tame pasture.

Both soils have medium potential for most urban uses. The shallow to moderate depth to rock and strong slopes are limitations for septic tank absorption fields, sewage lagoons, dwellings, and small commercial buildings. Low strength is the main limitation for roads and streets.

These soils are in capability subclass VIe. The Stephenville soil is in the Sandy Savannah range site, and the Darnell soil is in the Shallow Savannah range site.

45—Stephenville-Darnell complex, 3 to 12 percent slopes, severely eroded. This map unit is made up of severely eroded areas of the gently sloping to strongly sloping Stephenville soil and Darnell soil on uplands. The moderately deep Stephenville soil is usually on the side slopes between areas of the shallow Darnell soil. The Darnell soil is on ridge crests and side slopes. These soils are so intermingled that they are not shown separately on the soil map. They range in area from 20 to 120 acres. Individual areas range from 1/4 acre to 4 acres.

The soils in this complex have gullies that range from 10 to 200 feet apart, 2 to 20 feet in depth, and 1 to 16 feet in width. Rills are common.

Stephenville fine sandy loam makes up about 80 percent of each mapped area. Typically, the surface layer is yellowish brown fine sandy loam about 6 inches thick. The upper part of the subsoil is strong brown sandy clay loam to a depth of about 30 inches. The middle part of the subsoil is yellowish red sandy clay loam to a depth of about 30 inches. The lower part of the subsoil is coarsely mottled sandy clay loam in shades of red, brown, and yellow to a depth of about 38 inches. The underlying material is yellowish brown sandstone.

This soil is low in natural fertility and organic matter content. It ranges from slightly acid to strongly acid in the surface layer and subsurface layer and is medium acid or strongly acid in the subsoil. Permeability is moderate, runoff is rapid, and available water capacity is medium. The root zone is moderately deep and is easily penetrated by roots.

Darnell fine sandy loam makes up about 10 percent of each mapped area. Typically, the surface layer is grayish brown fine sandy loam about 5 inches thick. The subsoil is pale brown fine sandy loam to a depth of about 13 inches. The underlying material is yellowish brown sandstone.

This soil is low in natural fertility and organic matter content. It ranges from medium acid to neutral. Permeability is moderately rapid, runoff is rapid, and available water capacity is low. The root zone is shallow and is easily penetrated by plant roots.

Other soils make up about 10 percent of the mapped area. These are the Grainola, Aydelotte, Seminole, Niotaze, and Eram soils.

The soils in this complex have very low potential for cultivation and have low potential for hay and tame pasture. They are best suited to use as rangeland.

The soils in this complex have medium potential for most urban uses. The shallow to moderate depth to rock and strong slopes are limitations for septic tank absorption fields, sewage lagoons, and dwellings and buildings. Low strength is the main limitation for roads and streets.

These soils are in capability subclass VIe. The Stephenville soil is in the Eroded Sandy Savannah range site, and the Darnell soil is in the Eroded Shallow Savannah range site.

46—Teller loam, 1 to 3 percent slopes. This deep, well drained, very gently sloping soil is on uplands. Slopes are plane to very slightly convex. Individual areas range from 5 acres to more than 500 acres.

Typically, the surface layer is reddish brown loam to a depth of 16 inches. The upper part of the subsoil is reddish brown loam to a depth of about 22 inches. The middle part of the subsoil is yellowish red sandy clay loam to a depth of about 48 inches. The lower part of the subsoil is reddish yellow fine sandy loam to a depth of 60 inches.

Included with this soil in mapping, and making up about 20 percent of the mapped area, are soils that are similar but have a brown subsoil; 10 percent Konawa soils; and 5 percent is a soil that is similar to the Teller soil but is clayey in the lower part of the subsoil. Also included in mapping are 5 percent soils that are similar to the Teller soil but have grayish mottles below a depth of 40 inches.

This soil is high in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer and upper part of the subsoil and ranges from medium acid to neutral below. Permeability and runoff are moderate, and available water capacity is high. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is easily penetrated by plant roots.

This soil has high potential for growing row crops and small grains. Its potential is somewhat limited by its slopes. It has high potential for hay and tame pasture. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard where cultivated crops are grown. Terracing is essential on cropland to prevent excessive erosion. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help to reduce runoff and to control erosion.

This soil has high potential for most urban uses. Seepage is a limitation for sewage lagoons, but this can be overcome by the use of sealing agents or by lining the lagoon with clayey soil material.

This soil is in capability subclass IIe and the Loamy Prairie range site.

47—Teller loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on uplands. Slopes are plane to rolling. Individual areas range from 5 to 200 acres.

Typically, the surface layer is brown loam to a depth of about 12 inches. The upper part of the subsoil is brown loam to a depth of about 20 inches. The middle part of the subsoil is reddish brown sandy clay loam to a depth of about 48 inches. The lower part of the subsoil is yellowish red fine sandy loam to a depth of 65 inches.

Included with this soil in mapping, and making up about 30 percent of the mapped area, are soils that are similar but have clay or sandstone below a depth of 40 inches; soils that have a more silty subsoil; and Konawa soils.

This soil is high in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer and upper part of the subsoil and ranges from medium acid to neutral below. Permeability is moderate, runoff is rapid, and available water capacity is high. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

This soil has medium potential for row crops, but high yields can be obtained. It is limited by the slope and by the erosion hazard. Terracing is essential. This soil has high potential for other agricultural uses. Good tilth is easily maintained by returning crop residue to the soil. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help to reduce runoff and to control erosion.

This soil has high potential for most urban uses. Seepage is a limitation for sewage lagoons but can be overcome by the use of sealing agents or by lining the lagoon with clayey soil material.

This soil is in capability subclass IIIe and the Loamy Prairie range site.

48—Tullahassee fine sandy loam. This deep, nearly level, somewhat poorly drained soil is on flood plains of small streams and is subject to frequent flooding. Slopes are slightly concave. Individual areas range from 5 to 100 acres.

Typically, the surface layer is grayish brown fine sandy loam about 8 inches thick. The underlying material is pale brown fine sandy loam to a depth of about 30 inches. Below that are buried layers of an older soil. These layers are mottled, gray loam to a depth of about 48 inches and mottled, brown loam to a depth of 60 inches.

Included with this soil in mapping are soils that do not have buried layers within a depth of 60 inches and soils that have a water table at a depth of 40 to 60 inches during most of the growing season. Each of these soils makes up about 10 percent of the mapped area.

This soil is low in fertility and organic matter content. It ranges from slightly acid in the surface layer to moderately alkaline below. Permeability is moderately rapid, runoff is slow, and available water capacity is high. This soil has good tilth. It has an apparent water table at a

depth of 2 to 3 feet during winter and spring. The root zone for most plants is shallow, but it is deep for water-tolerant plants.

This soil has high potential for tame pasture, and high yields can be obtained. Potential for small grains and row crops is very low because of wetness and flooding.

Potential for urban uses is low. The main limitations for most urban uses are flooding and wetness.

This soil is in capability subclass Vw and the Subirrigated range site.

49—Waurika silt loam, 0 to 1 percent slopes. This deep, somewhat poorly drained, nearly level soil is on uplands. Slopes are plane to slightly concave. Individual areas range from 5 to 20 acres.

Typically, the surface layer is gray silt loam about 9 inches thick. The subsurface layer is light gray silt loam to a depth of about 11 inches. The upper part of the subsoil is dark gray clay to a depth of about 30 inches. The middle part of the subsoil is grayish brown clay to a depth of about 44 inches. The lower part of the subsoil is coarsely mottled, yellowish brown and gray clay loam to a depth of 60 inches.

Included with this soil in mapping, and making up about 10 to 15 percent of the mapped area, are soils that are similar but do not have a subsurface layer and soils that are similar but have a subsoil that has sodium salts. Also included are areas of Seminole soils. Individual areas of each of these soils are generally less than 1 acre in size.

This Waurika soil is high in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer and ranges from neutral to moderately alkaline below. Permeability is very slow, runoff is slow, and available water capacity is high. This soil has a perched water table at a depth of 1 foot to 2 feet during winter and spring. It has good tilth in most areas, but tilth can be easily destroyed by working the soil when it is too wet. The root zone is deep, but root penetration is slow because of the tight clay subsoil and because of the water table.

This soil has medium potential for growing row crops and small grains. Yields are decreased to some extent by the perched water table. This soil has high potential for hay and tame pasture. Good tilth is maintained by returning crop residue to the soil. Erosion is only a slight hazard where cultivated crops are grown. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help to reduce runoff and to maintain tilth.

This soil has medium potential for most urban uses. High shrink-swell potential, wetness, and low strength are limitations for dwellings, small commercial buildings, and roads and streets. Most of these limitations can be overcome with good design and careful installation. Surface drainage can be improved by shaping. Septic tank absorption fields will not operate satisfactorily in this soil because of very slow permeability and wetness. Sewage lagoons work well.

This soil is in capability subclass IIw and the Claypan Prairie range site.

50—Wynona silt loam. This deep, somewhat poorly drained, nearly level soil is on the flood plains and is occasionally flooded. Slopes are plane to concave and less than 1 percent. Individual areas range from 5 to 25 acres.

Typically, the surface layer is grayish brown silt loam to a depth of 6 inches, gray silty clay loam to a depth of about 20 inches, and mottled grayish brown silty clay loam to a depth of about 32 inches. The upper part of the subsoil is mottled, grayish brown silty clay loam to a depth of about 48 inches. The lower part of the subsoil is mottled, dark gray silty clay loam to a depth of 60 inches.

Gowton soils make up about 10 percent of this map unit. Soils that are similar to the Wynona soil but have up to 20 inches of fine sandy loam overburden make up about 10 percent of the mapped area. Also included with this soil in mapping, and making up about 5 percent of the mapped area, are areas of Tullahassee soils. About 3 percent of the map unit is soils that are similar to the Wynona soil but have a reddish brown subsoil that is moderately alkaline and calcareous throughout. These soils are near streams that mostly drain limestone areas.

This Wynona soil is high in natural fertility and organic matter content. It ranges from neutral or mildly alkaline in the surface layer to slightly acid or neutral in the subsoil. Permeability and runoff are slow, and available water capacity is high. This soil has a perched water table within 2 feet of the surface during winter and spring. It has good tilth but is usually too wet during spring planting time to work up a good seedbed. The root zone is deep and is easily penetrated by roots. When the water table is near the surface, root growth is restricted, and some plant roots, such as alfalfa, die back at the water table.

This soil has high potential for row crops, small grains, permanent hay, and tame pastures. Flooding and wet soils at harvest time are the chief hazards. Good tilth is maintained by returning crop residue to the soil and refraining from tilling when the soil is wet. The chief management concerns are soil fertility and controlled grazing.

This soil has low potential for most urban uses. Flooding and wetness are the main limitations for septic tank absorption fields, sewage lagoons, trench and area sanitary landfills, and dwellings and small commercial buildings. All of these limitations can be overcome, but the solutions are usually not economical. Sewage lagoons can be used if protected by flood control structures or if embankments are of sufficient height to prevent flooding.

This soil is in capability subclass IIw and the Loamy Bottomland range site.

51—Yahola fine sandy loam. This deep, well drained, nearly level soil is on flood plains of the larger streams and is occasionally flooded. Slopes are plane and slightly undulating. Individual areas range from 20 to more than 200 acres.

Typically, the surface layer is pale brown fine sandy loam 7 inches thick. The underlying material to a depth of about 44 inches is light yellowish brown fine sandy loam that has strata of coarser and finer material. Below that is a buried, older soil that is dark grayish brown loam to a depth of 60 inches.

Included with this soil in mapping is about 10 percent Gaddy soils. About 5 percent of the mapped area is soils that are similar to the Yahola soil but have a very dark grayish brown surface layer that is more than 10 inches thick. Also included with this soil in mapping, and making up about 5 percent of the mapped area, are somewhat poorly drained soils that have a very dark grayish brown clayey surface layer and clayey subsoil about 14 to 30 inches thick over stratified loamy and sandy soil material. Gowton soils make up about 5 percent of this map unit.

This soil is low in natural fertility and organic matter. It is mildly alkaline or moderately alkaline in the surface layer and moderately alkaline and calcareous below the surface layer. Permeability is moderately rapid, runoff is slow, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

This soil has high potential for row crops and small grains. It is somewhat droughty, especially for summer crops. Occasional floods cause some crop losses. This soil has high potential for hay and tame pasture. Good tilth is easily maintained by returning crop residue to the soil. The wind erosion hazard is moderate. It occurs when the soil is nearly bare and there are high winds. A cover crop controls wind erosion and helps to maintain tilth.

This soil has low potential for most urban uses. The principal limitation for nearly all urban uses is flooding.

This soil is in capability subclass IIw and the Loamy Bottomland range site.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, windbreaks and environmental plantings, and as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities; and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

Ted Lehman, agronomist, Soil Conservation Service, helped prepare this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the predicted yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of man-

agement systems for individual fields or farms, should also consider the detailed information given in the description of each soil.

About 22,000 acres in the survey area is used for crops. About 40 percent is used for row crops, mainly peanuts, soybeans, and grain sorghums. The remaining 60 percent is close grown crops, mainly wheat and alfalfa. There are about 125,000 acres of tame pasture in the survey area. The dominant grasses are improved bermudagrass and fescue.

Potential of the soils in the county for increased production of crops is high. About 100,000 acres of soils that are potentially good for use as cropland (those in capability classes I, II, and III) are currently being used for pasture, range, and woodland. In addition, production of present cropland could be considerably increased through use of the latest crop production technology. This soil survey can greatly facilitate the application of such technology.

Potential for increased pasture production is also high. About 65,000 acres of land that is presently in brushy rangeland is suitable for pasture. Yields of many of the pastures are low and could be increased considerably by improving stands, more overseeding of legumes, increased usage of fertilizer, and better management of grazing.

Soil erosion is the major soil problem on about two-thirds of the cropland and pasture in Seminole County. If the slope is more than 1 percent, erosion is a hazard. The Bates, Konawa, Prue, Seminole, Stephenville, and Teller soils, for example, have problems of erosion.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such the Aydelotte and Seminole soils, and on soils that have a layer in or below the subsoil that limits the depth of the root zone and limits the available water capacity, such as the Bates, Catoosa, Coweta, and Stephenville soils. Erosion also reduces productivity on soils that tend to be droughty, such as the Eufaula and Wewoka soils. Second, soil erosion on farmland results in sediment entering streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

In many sloping fields, preparing a good seedbed and tilling are difficult on clayey or hardpan spots, because the original, friable surface layer has been eroded away. Such spots are common in areas of Aydelotte soils and the moderately eroded Seminole soils.

Erosion control practices provide a protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that do not reduce the productive capacity of the soils. On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land, provide nitrogen, and improve tilth for the next crop. Minimizing tillage and leaving crop residue on the surface help to increase infiltration and to reduce the hazards of runoff and erosion.

Terraces and diversions reduce the length of slope and reduce runoff and erosion. They are not practical on deep, well drained soils that have regular slopes. The Chickasha, Konawa, Prue, Seminole, and Teller soils are suitable for terraces. Some other soils are suitable for terraces and diversions because of irregular slopes, a clayey subsoil that would be exposed in terrace channels, or bedrock at a depth of less than 40 inches.

Contouring in conjunction with terraces is a widespread erosion control practice in the survey area. This practice is best adapted to soils that have smooth, uniform slopes, including most areas of the Bates, Chickasha, Konawa, Prue, Seminole, Stephenville, and Teller soils.

Soil blowing is a hazard on the sandy Dougherty, Eufaula, and Gaddy soils. It can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining a vegetative cover or using surface mulch minimizes soil blowing on these soils. Windbreaks are effective in reducing soil blowing. For further information about windbreaks, see the section on "Windbreaks and environomental plantings."

Soil fertility is naturally low in many upland soils in the survey area. The soils on flood plains, such as the Gowton, Madill, Wynona, and Yahola soils, are naturally higher in plant nutrients than most upland soils.

Many upland soils are naturally medium acid or strongly acid. If they have never been limed, they require applications of ground limestone to sufficiently raise the pH level for good growth of alfalfa and other crops that grow only on nearly neutral soils. Available phosphorus, nitrogen in most soils, and potash levels are low in some soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Serice can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Most of the soils used for crops in the survey area have a loamy surface layer that has weak structure and a low to moderate content of organic matter. Under intense rainfall a crust forms on the surface. The crust is hard when the soil is dry and is nearly impervious to water. Once the crust forms, it reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material helps to improve soil structure and to reduce crust formation.

Fall plowing is generally not a good practice on soils that have a sandy surface layer because of wind erosion during winter and spring. About one-half of the cropland is soils that are subject to damaging erosion if they are plowed in the fall. Crop residue is beneficial if left on the surface as long as possible before the next crop.

The Aydelotte and Dennis soils have a clayey subsoil. Tilth is a problem because the soils often stay wet until late in spring. If the soils are wet when plowed, they tend to be very cloddy when dry, making good seedbeds difficult to prepare. Fall plowing on these soils generally results in better tilth than plowing in spring.

Drainage is the major need on soils that are used for crops in the survey area. Some soils are naturally so wet that the production of crops common to the area is generally reduced. These are the poorly drained and somewhat poorly drained Gracemont, Gracemore, Harjo, Tullahassee, and Wynona soils in the survey area (fig. 6). These soils are used mainly for tame pasture or range where wetness is beneficial.

Surface drainage is sometimes a problem on Asher, Gowton, Harjo, Okemah, Roebuck, Waurika, and Wynona soils. Drainage ditches can be constructed to remove the excess surface water on most of these soils. Information on drainage design for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Field crops that are suited to the soils and climate of the survey area include many crops that are not now commonly grown. Peanuts, grain sorghum, and, to an increasing extent, soybeans are the row crops. Cotton, corn, potatoes, and similar crops can be grown if economic conditions are favorable. Summer-grown crops, such as peanuts, occasionally need irrigation, especially during July and August, to insure a good yield. Wheat and alfalfa are common close-growing crops. Barley and oats can be grown, and seed can be produced from rye, vetch, fescue, alfalfa, and lovegrass.

Special crops grown commercially in the survey area are very limited but include vegetables, small fruits, tree fruits, and nursery plants. A small acreage throughout the survey area is used for watermelons, strawberries, blackberries, okra, sweet corn, tomatoes, summer squash, peppers, potatoes, and other vegetables. Additional acreage can be devoted to these and other special crops. A few acres of apples and peaches are grown in the area. Pecans are native to the soils on flood plains, and in some years, returns are good from existing native trees. Improved varieties of pecans and insect control can make this an important crop.

Deep soils that have good natural drainage and are not droughty are especially well suited to many vegetables. Examples of these soils in the survey are the Asher, Gowton, Keokuk, Konawa, and Teller soils. Irrigation is essential for good production most of the time.

Many of the well drained soils in the survey area are suitable for orchards and nursery plants. Soils on flood plains, where frost is frequent and air drainage is poor, are generally poorly suited to early vegetables, small fruits, and orchards. Pecans are an exception because they are not generally susceptible to late frosts.

Pecan trees have a very deep root system, and moisture requirements are high. They do best on flood plain soils, such as Asher, Gaddy, Gowton, Keokuk, Madill, Wynona, and Yahola soils, and on upland soils, such as Konawa, Teller, and Prue soils.

The latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Management of soils for tame pasture

Pasture plants that are grown and guidelines for managing them are described in this section.

Nearly one-third of the acreage in the survey is tame pasture. Many idle fields, formerly cropland, and native range in poor condition are being converted to tame pasture. Most of the soils in the county are suited to tame pasture.

The principal tame grasses are improved bermudagrass and fescue.

The better pastures of bermudagrass are overseeded with warm season legumes such as Korean lespedeza or yellow hop clover. The legumes in the bermudagrass pasture provide additional plant food and increase the quality and quantity of forage. Small grains and vetch are often overseeded with bermudagrass early in fall. This provides some winter and spring forage when the bermudagrass is dormant. Fertilizer should be applied to supply the needs of small grains and vetch.

Fescue is an important grass in the survey area. It provides a sufficient quantity of forage on soils that have high available water capacity, such as Asher or Wynona soils. Fescue is used in the pasture program with other forages to furnish grazing and additional protein late in fall, in winter, and in spring. To maintain a vigorous stand, it needs to be fertilized early in spring and early in fall, and it should not be grazed during summer.

Some pastures are a mixture of bermudagrass and fescue. This grass mixture is especially adapted to flood plain soils where additional moisture is available. It provides grazing in nearly all months and furnishes added protein for livestock during the months bermudagrass is dormant.

Some areas of cropland are used for growing winter small grains to supplement the permanent grasses. These crops are used in the pasture program to provide grazing and to add protein for livestock late in fall, in winter, and in spring. The soil needs to be seeded and fertilized early in fall in order to obtain the maximum amount of forage. Small grains can be grazed until maturity, or livestock can be removed during spring to allow the plants to grow a seed or a hay crop for harvest.

Forage sorghum is also used on some cropland areas to provide additional forage. It can be used in the pasture program to provide grazing during summer, or the forage can be harvested for hay. Occasionally forage sorghum is allowed to grow until frost comes and is grazed during winter. Fertilizer needs to be added to the soil in order for sorghum to have maximum growth. The percentage of forage yields for grazing is listed under grass or crop by month in table 5.

The kind of soil and plants must be considered in order to obtain good pasture management. Good pasture can be achieved by managing to maintain the desired kind and stand of plants. Plants must have vigor to obtain a proper balance in the stand. Grazing needs to be compatible with the kind of growth pasture plants have.

Proper grazing and rotational grazing help to lengthen the life of most pasture plants. Deferred grazing during the time that pasture plants are under low food reserve is beneficial. This allows the plants to regain vigor by helping them to maintain a more adequate root system where food can be stored for the next growing season. Total production of forage increases.

Plant food that contains the proper elements contributes to more vigorous pasture plants. This helps to increase forage production and to lengthen the lifespan of the plants. Plant food can be added by using commercial fertilizers or legumes, such as vetch seeded in bermudagrass which furnishes nitrogen to the plants (fig. 7). The acidity of the soil needs to be adjusted to the kind of plants desired in the stand. Larger amounts of plant food are needed in areas where legumes are not grown with the grass.

The desired kind of pasture plants can only be maintained in the stand by controlling the invasion of undesirable plants. Weeds need to be controlled. Brush management is essential. A mowing or spraying program that is properly used helps to reduce the problem created by weeds and brush.

A pasture program needs to be planned to provide the desired amount of forage during each month of the year. A study of the growth habits of the different plants is necessary to assure adequate forage during each month. The months during which various kinds of forage plants grow are indicated in figure 8. The percentage of growth that can be safely grazed each month without substantially reducing the total yield for each kind of plant is illustrated by this graph. For example, 20 percent of the yearly growth of bermudagrass can be grazed during June.

Soils vary in their ability to produce forage for grazing. Gowton soils produce more forage than Coweta soils primarily because Gowton soils furnish more available moisture to the plant. The total yearly production of each soil for various kinds of pasture plants is given in animal unit months (AUM) in table 5. Bates loam, 1 to 3 percent slopes, in bermudagrass pasture, furnished grazing for one animal unit (AUM) 6 months during the year.

In planning a pasture program, one must consider the total yearly production of the pasture plant in AUM (table 5) and the amount of growth the plant will make for a certain month (fig. 8). As illustrated in figure 8, bermudagrass furnished 20 percent of its annual forage during June. Bermudagrass provides grazing for 1.2 animals (.20 X 6 AUM = 1.2 AUM) on the Bates soil, since its yearly production is 6 AUM as indicated in table 5. A pasture of 50 acres can furnish grazing for 60 animals (50 acres X 1.2 AUM = 60 AUM) during June. Personnel in the Soil Conservation Service or County Extension Office can assist in planning a total pasture program for a farm.

Periods of low rainfall are common, may last for a month or more, and may be below normal for a year or more. Yields in table 5 are an average based on several years of study. To insure continuous adequate forage during these dry periods, numbers of livestock must fluctuate or a reserve is needed. This reserve can be provided in two ways. First, by harvesting part of the pasture for hay during periods of above normal moisture, and second, by holding over growth from the growing season to a later period. For example, the use of a reserve pasture of bermudagrass grown in May and June can be delayed until a dry period in August and Sepember, which is an occasional occurrence. Too close grazing should be avoided, however, because during this period storage roots are developed so that plants can survive the winter.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the soil is not suited to the crop or the crop is not commonly grown on the soil or that a given crop is not commonly irrigated.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 6.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop

varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown; that good quality irrigation water is uniformly applied in proper amounts as needed; and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. Only the class and subclass levels are used in this survey. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, which is not used in this survey area, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability subclass is identified in the description of each soil map unit in the section "Soil maps for detailed planning."

Rangeland

Ernest Snook, range conservationst, Soil Conservation Service, helped prepare this section.

This section provides information about the use of soils for rangeland. It describes the grouping of soils into range sites and discusses management of the soils in each range site (fig. 9).

Rangeland is land on which the natural plant community is composed mainly of grasses, grasslike plants, forbs, and shrubs that are valuable for grazing and abundant enough to justify grazing by domestic animals (fig. 10).

Rangeland makes up about 60 percent of the county. Approximately one-half of the area is open prairie, and the other one-half is savannah. The savannah is covered with a mixture of trees and an understory of grasses and forbs.

The raising of beef cattle is the main agricultural enterprise in the survey area. A few large ranches are in the county, but most of the rangeland is in livestock farms. Most rangeland is used in conjunction with tame pasture.

The grazing of crop stubble and wheat is common and provides additional forage in fall and winter. Native range and tame pasture forage is often supplemented with protein concentrates (fig. 11).

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 7 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 7.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Characteristic species of grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil are listed by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Windbreaks and environmental plantings

Norman E. Smola, forester, Soil Conservation Service, helped prepare this section.

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and needleleaved species provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field, the interval depending on erodibility of the soil. They protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 8 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 8 based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Engineering

Forrest McClung, engineer, Soil Conservation Service, helped prepare this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 9 shows, for each kind of soil, the degree and kind of limitations for building site development; table 10, for sanitary facilities; and table 12, for water management. Table 11 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 9. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 9 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a water table were also considered. Soil wetness and depth to a water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 9 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 10 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, and *poor*, which mean about the same as *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavat-

ed trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 10 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

If it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 11 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction material. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 15 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low frost action potential, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 11 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 15.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can restrict plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils or very firm clayey soils; soils that have suitable layers less than 8 inches thick; soils that have large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 12 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the specified use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of the soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 12 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 13 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 13 can be supplemented by information in other parts of this survey. Especially help-

ful are interpretations for septic tank absorption fields, given in table 10, and interpretations for dwellings without basements and for local roads and streets, given in table 9.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

Jerry Sykora, biologist, Soil Conservation Service, helped prepare this section.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 14, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of habitat are very severe and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, Illinois bundleflower, ragweed, wheatgrass, and grama.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit,

buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of hardwood plants are oak, sweetgum, hawthorn, dogwood, hickory, and blueberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, cedar, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are sumac, skunkbush, redcedar, and big sagebush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, and cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bodwhite quail, meadowlark, field sparrow, cottontail, and red fox.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include antelope, white-tailed deer, desert mule deer, raccoon, jackrabbit, tree squirrels, meadowlark, and turkey.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features and engineering test data.

Engineering properties

Table 15 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 15 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 15 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7

to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 18. The estimated classification, without group index numbers, is given in table 15. Also in table 15 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and in plasticity index is estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 16 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Bulk density is a measure of the weight of soil per unit of volume. It may be used to detect soil horizons that limit plant growth. Growth of roots is restricted by densities of moist soil as high as 1.8 grams per cubic centimeter.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems. It is commonly expressed as inches of water per inch of soil.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25

degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 16. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is estimated in soils by multiplying the amount of organic carbon by the factor 1.732. Organic carbon was determined by acid dichromate digestion and ferrous sulfate titration. Organic matter has a cation exchange capacity of several hundred milliequivalents per 100 grams, and therefore it adds considerably to the cation exchange capacity of soils.

Soil and water features

Table 17 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 17 are the depth to the high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 18.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the Oklahoma Department of Highways, Material Division (*3*).

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods assigned by the American Association of State Highway and Transportation Officials. The codes for shrinkage, Unified classification, and California bearing ratio are those assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-49); Unified classification (D-2487-69T); mechanical analysis (T88-57); liquid limit (T89-60); plasticity index (T90-56); moisture-density, method A (T99-57); Shrinkage (D-427).

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*4*). Unless otherwise noted, colors described are for dry soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Asher series

The Asher series consists of deep, moderately well drained, nearly level or slightly concave, slowly permeable soils that formed in loamy alluvial sediment. These soils have contrasting textures between the upper and lower part of the control section. They are mainly on broad flood plains of the major rivers. Asher soils are the

farthest from the river channel that is adjacent to the uplands or next to the older terraces that are higher in elevation. Slopes are less than 1 percent.

Asher soils are geographically closely associated with the Gaddy, Gracemore, Keokuk, and Yahola soils. Gaddy, Gracemore, and Yahola soils are at a lower elevation in the flood plain. Gaddy and Gracemore soils have a sandy control section, and Yahola soils have a coarse-loamy control section. Keokuk soils are at the same elevation on the flood plain but are the closest to the river channel. They have a coarse-silty control section.

Typical pedon of the Asher silty clay loam, in a cultivated field 6.25 miles west and 1 mile north of the intersection of Interstate 40 and State Highway 99 north of Seminole, 2,640 feet north and 1,300 feet west of the southeast corner of sec. 27, T. 11 N., R. 5 E.:

A1—0 to 12 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate medium granular structure in the upper 3 inches parting to moderate medium and fine subangular blocky below; extremely hard, firm; mildly alkaline; clear smooth boundary.

B2—12 to 22 inches; brown (7.5YR 5/2) silty clay loam, brown (7.5YR 4/2) moist; weak medium and fine subangular blocky structure; extremely hard, very firm; calcareous; moderately alkaline; clear smooth boundary.

IIC—22 to 60 inches; pale brown (10YR 6/3) very fine sandy loam; brown (10YR 5/3) moist; massive; hard, friable; common thin strata of brown silt loam, fine sandy loam, and dark grayish brown silty clay loam; few films of secondary carbonates; calcareous; moderately alkaline.

Solum thickness ranges from 22 to 30 inches. Depth to secondary carbonates ranges from 12 to 30 inches, and depth to coarse-silty material ranges from 20 to 34 inches. Buried soils are in some pedons below a depth of 50 inches.

The A horizon is very dark grayish brown (10YR 3/2), dark gray (10YR 4/1), dark grayish brown (10YR 4/2), or dark reddish gray (5YR 4/2). Reaction is neutral or mildly alkaline. Structure is moderate or weak, medium or fine granular, and some pedons have weak to moderate, medium or fine subangular blocky structure in the lower part.

The B horizon is brown (7.5YR 5/2), dark grayish brown (10YR 4/2), dark reddish gray (5YR 4/2), and reddish brown (5YR 5/3). Reaction ranges from neutral to moderately alkaline and may or may not be calcareous.

The IIC horizon is pale brown (10YR 6/3) or brown (7.5YR 5/4). It is silt loam, loam, or very fine sandy loam with strata of fine sandy loam, loamy very fine sand, very fine sand, or silty clay loam. The strata range from 1/8 inch to 6 inches thick but are mostly less than 3 inches thick.

Aydelotte series

The Aydelotte series consists of deep, well drained, very gently sloping or sloping, very slowly permeable soils that formed in material weathered from reddish shale. These soils are on uplands. Slopes are mostly 2 to 5 percent, but some small areas of less than 2 percent are on ridgetops.

Aydelotte soils are geographically closely associated with Chickasha, Grainola, Lucien, Seminole, and Waurika soils. Chickasha soils are mostly on lower lying slopes or ridgetops and have a fine-loamy control section. Grainola soils are on steeper slopes and have a thinner solum. Lucien soils are on ridges and range from 10 to 20 inches in thickness. Seminole soils are on lower lying slopes and ridges, have a thicker epipedon, and have a natric horizon. The Waurika soils have a thicker epipedon, an albic horizon, and aquic properties.

Typical pedon of Aydelotte loam, from an area of Aydelotte loam, 2 to 5 percent slopes, in a pasture 1 mile west and 2 miles north of Konawa, 1,500 feet west and 1,400 feet north of the southeast corner of sec. 15, T. 6 N., R. 5 E.:

Ap—0 to 5 inches; reddish brown (5YR 5/3) loam, dark reddish brown (5YR 3/3) moist; weak fine granular structure; hard, friable; neutral; clear smooth boundary.

B21t—5 to 21 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium and fine angular and subangular blocky structure; extremely hard, very firm; nearly continuous reddish brown (10YR 5/3, 4/3) clay films on faces of peds; neutral; diffuse smooth boundary.

B22t—21 to 40 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; weak to moderate medium subangular blocky structure; extremely hard, very firm; few patches of reddish brown (5YR 4/3) clay films on faces of peds; few slickensides; few soft bodies of calcium carbonate, some with hard centers; few fine black bodies; reddish brown (5YR 5/3) silt coatings on some vertical faces of peds; moderately alkaline; diffuse smooth boundary.

B3—40 to 62 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; weak coarse subangular blocky structure; extremely hard, very firm; patchy clay films on faces of peds; few slickensides; few fine black bodies; few soft bodies of calcim carbonate, some with hard centers, becoming common in lower part; moderately alkaline.

Thickness of the solum ranges from 60 to more than 75 inches. A few slickensides are in the B22t and B3 horizons of some pedons, but they do not intersect.

The A horizon is reddish brown (5YR 5/3, 4/4, 5/4) or brown (7.5YR 5/3). Reaction is slightly acid or neutral.

The B21t horizon is reddish brown (5YR 4/4, 5/4) or yellowish red (5YR 4/6). Reaction ranges from slightly acid to mildly alkaline, and texture is clay or clay loam. The B22t horizon is red (2.5YR 4/6, 5/6; 5YR 4/6) or reddish brown (5YR 5/4). Texture is clay or silty clay. The B3 horizon is red (2.5YR 4/6, 5/6), yellowish red (5YR 4/6), or reddish brown (2.5YR 5/4; 5YR 5/4). Texture is clay or silty clay.

Bates series

The Bates series consists of moderately deep, well drained, very gently sloping or gently sloping, moderately permeable soils that formed in material weathered from sandstone. These soils are on uplands. Slopes are mainly 1 to 5 percent.

Bates soils are geographically closely associated with Carytown, Coweta, Dennis, Eram, Okemah, and Prue soils. Carytown, Dennis, and Okemah soils are on lower parts of slopes or on slopes adjacent to the Bates soils. Carytown, Dennis, and Okemah soils are more than 60 inches thick and have a fine control section. In addition, Carytown soils have a natric horizon, and Dennis and Okemah soils have aquic properties. Coweta soils are on ridges and are less than 20 inches deep over sandstone. Eram and Prue soils are on adjacent foot slopes and side slopes. Eram soils have a fine control section and aquic properties. Prue soils are more than 60 inches thick and are on foot slopes.

Typcial pedon of Bates loam, from an area of Bates loam, 1 to 3 percent slopes, in a pasture 3 miles north and 2 1/2 miles east of Wewoka, 1,800 feet west and 900 feet north of the southeast corner sec. 34, T. 9 N., R. 8 E.:

A1—0 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; hard, friable; slightly acid; clear smooth boundary.

B1—13 to 20 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; hard, friable; slightly acid; gradual smooth boundary.

B2t—20 to 38 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; very hard, friable; few cracks filled with dark brown sediment; thin discontinuous clay films on faces of peds; about 10 percent by volume of yellowish red (10YR 5/6, 6/6) soft sandstone fragments below 30 inches and increasing with depth; slightly acid.

Cr—38 to 42 inches; yellowish brown soft, weathered sandstone with 10 percent of the cracks filled with soil similar to the B2t horizon.

Solum thickness ranges from 20 to 40 inches. Sandstone fragments are in any horizon and range from 0 to 35 percent. Reaction ranges from medium acid to neutral throughout the profile. Where limed, the A horizon is mildly alkaline.

The A horizon is grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2), or brown (10YR 5/3, 4/3). Texture is loam or fine sandy loam.

The B1 horizon is grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), or brown (10YR 5/3, 4/3). Texture is loam, clay loam, or fine sandy loam. The B2t horizon is brown (10YR 5/3, 4/3), pale brown (10YR 6/3), yellowish brown (10YR 5/4), light yellowish brown (10YR 6/4), or brownish yellow (10YR 6/6). Texture is loam, clay loam, or sandy clay loam. Some pedons have common mottles with a chroma of three or more. Some pedons have a B3 horizon. Where present, it has the same range of characteristics as the B2t horizon, but it may have many mottles with a chroma of three or more.

The Cr horizon is weathered, soft yellowish brown sandstone.

The Bates soils in this county are taxadjuncts to the Bates series because they are slightly more alkaline in reaction and are dry for slightly longer periods than described in the range for the series. Otherwise, they are similar in morphology, use, behavior, and management.

Carytown series

The Carytown series consists of deep, poorly drained, nearly level to very gently sloping, very slowly permeable soils that formed in clayey material weathered from shale. These soils are on concave uplands. They have a perched water table within 1 foot of the surface during winter and spring. Slopes are mainly 0 to 2 percent.

Carytown soils are geographically closely associated with the Coweta and Eram soils and are adjacent to Bates, Dennis, Okemah, and Prue soils. None of these soils have a natric horizon. Bates and Prue soils are in higher positions and have a fine-loamy control section. In addition, Bates soils are 20 to 40 inches inches deep over sandstone. Coweta soils are in high positions and are 10 to 20 inches deep over sandstone. Eram soils are in higher positions and are 20 to 40 inches deep over shale. Okemah and Dennis soils are on higher positions and have a mollic epipedon.

Typical pedon of Carytown silt loam, from an area of Okemah-Carytown complex, 0 to 2 percent slopes, in a pasture 2 miles north of Wewoka, 2,350 feet west and 1,400 feet north of the southeast corner of sec. 5, T. 8 N., R. 8 E.:

Ap—0 to 6 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; massive; hard, friable; mildly alkaline; abrupt smooth boundary.

B21t—6 to 12 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; few fine distinct gray and yellowish brown mottles; moderate medium columnar structure parting to strong medium subangular blocky; hard, firm; nearly continuous clay films on faces of peds; common gray silt coatings on some faces of peds; neutral; gradual smooth boundary.

B22t—12 to 35 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; few fine distinct gray and yellowish brown mottles; moderate medium subangular and angular blocky structure; extremely hard, very firm; nearly continuous clay films on faces of peds; common gray silt coatings on faces of peds; moderately alkaline; gradual smooth boundary.

B23t—35 to 50 inches; light brownish gray (10YR 6/2) silty clay, grayish brown (10YR 5/2) moist; common medium distinct yellowish brown (10YR 5/6) and gray (10YR 5/1) mottles; weak medium subangular blocky structure; extremely hard, very firm; patchy clay films on faces of peds; common gray silt coatings on faces of peds; few slickensides; few small black bodies; moderately alkaline; gradual smooth boundary.

B3—50 to 72 inches; light yellowish brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; many coarse prominent brownish yellow (10YR 6/6), grayish brown (10YR 5/2), and very dark grayish brown (10YR 3/2) mottles; weak coarse subangular blocky structure; extremely hard, very firm; patchy clay films on faces of peds; few slickensides; few small black bodies; moderately alkaline.

Solum thickness is more than 60 inches. Reaction ranges from slightly acid to mildly alkaline in the A1 or Ap horizon, neutral to moderately alkaline in the B21t horizon, and it is moderately alkaline below. Mottling is in the B2t and B3 horizons.

The A horizon is 4 to 10 inches thick. It is grayish brown (10YR 5/2) or light brownish gray (10YR 6/2).

The B21t horizon is dark gray (10YR 4/1), gray (10YR 5/1), or grayish brown (10YR 5/2). Texture is silty clay loam or silty clay. The B22t horizon is brown (10YR 5/3, 4/3), grayish brown (10YR 5/2), or dark grayish brown (10YR 4/2). Texture is silty clay, clay, or silty clay loam. The B23t horizon, where present, is grayish brown (10YR 5/2), brown (10YR 5/3), or light brownish gray (10YR 6/2). Texture is clay or silty clay. The B3 horizon is yellowish brown (10YR 5/4) or light yellowish brown (10YR 6/4) with common to many, medium to large, yellowish brown or grayish brown mottles. Some pedons have a coarsely mottled B3 horizon. Texture is clay or silty clay.

The Carytown soils in this county are taxadjuncts to the Carytown series because they have a thinner A horizon and do not have the A2 horizon described in the range for the series. Otherwise, they are similar in morphology, use, behavior, and management.

Catoosa series

The Catoosa series consists of moderately deep, well drained, very gently sloping, moderately permeable soils that formed in material weathered from limestone. These soils are on uplands. Slopes are mainly 1 to 3 percent.

Catoosa soils are geographically closely associated with Newtonia and Shidler soils. Newtonia soils are more than 60 inches thick. Shidler soils are on ridges and are 10 to 20 inches deep over limestone.

Typical pedon of Catoosa silt loam, from an area of Newtonia-Catoosa complex, 1 to 3 percent slopes, in a hay field 3 miles west and 2 miles south of Wewoka, 3,100 feet north and 50 feet east of the southwest corner of sec. 35, T. 8 N., R. 7 E.:

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; hard, friable; slightly acid; abrupt smooth boundary.

A1—7 to 14 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

B1—14 to 22 inches; brown (7.5YR 5/3) silt loam, dark brown (7.5YR 3/3) moist; weak medium subangular blocky structure; hard, friable; neutral; clear smooth boundary.

B2t—22 to 32 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; very hard, firm; nearly continuous brown (7.5YR 4/4) clay films on faces of peds; common soft black bodies; neutral; gradual smooth boundary.

R—32 to 34 inches; light gray, hard limestone.

Solum thickness and depth to bedrock range from 20 to 40 inches. The A horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), reddish brown (5YR 4/3), and dark reddish gray (5YR 4/2). Reaction is slightly acid or neutral.

The B1 horizon is dark brown (7.5YR 3/3, 4/3) or brown (7.5YR 5/3). Texture is silty clay loam, clay loam, or silt loam. Reaction is slightly acid or neutral. The B2t horizon is reddish brown (5YR 4/4), yellowish red (5YR 5/6), or brown (7.5YR 5/4, 5/3). Texture is silty clay loam or clay loam, and reaction is slightly acid or neutral.

The R layer is hard, light gray limestone.

The Catoosa soils in this county are taxadjuncts to the Catoosa series because they are slightly more alkaline in reaction, have browner colors, and are dry for slightly longer periods than described in the range for the series. Otherwise, they are similar in morphology, use, behavior, and management.

Chickasha series

The Chickasha series consists of deep, well drained, very gently sloping to gently sloping, moderately permeable soils that formed in material weathered from sandstone. These soils are on uplands. Slopes are mainly 2 to 5 percent.

Chickasha soils are geographically closely associated with Waurika soils and are adjacent to the Aydelotte, Grainola, Lucien, and Seminole soils. Aydelotte and Seminole soils have a fine control section. Grainola and Lucien soils are on steeper positions on the landscape. In addition, Grainola soils are clayey and moderately deep over shale, and Lucien soils are shallow over sandstone. Waurika soils are on plane to slightly concave areas and have a fine control section.

Typical pedon of Chickasha loam, in an area of Chickasha loam, 2 to 5 percent slopes, 1,700 feet north and 200 feet west of the southeast corner of sec. 4, T. 9 N., R. 6 E.:

A1—0 to 10 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; slightly acid; clear smooth boundary.

B1—10 to 18 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; hard, friable; patchy clay films on faces of peds; slightly acid; clear smooth boundary.

B21t—18 to 32 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; common fine distinct red mottles; moderate medium subangular blocky structure; very hard, firm; nearly continuous clay films on faces of peds; medium acid; clear smooth boundary.

B22t—32 to 48 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; common medium distinct red (2.5YR 4/8) mottles; moderate medium subangular blocky structure; very hard, firm; patchy clay films on faces of peds; slightly acid; gradual smooth boundary.

B3—48 to 56 inches; coarsely mottled light gray (10YR 7/1), strong brown (7.5YR 5/8), and red (2.5YR 4/8) sandy clay loam; weak coarse subangular blocky structure; very hard, firm; patchy clay films on faces of peds; slightly acid; clear smooth boundary.

Cr—56 to 62 inches; weathered, yellowish brown soft sandstone, common grayish mottles.

Solum thickness and depth to sandstone bedrock range from 40 to 60 inches.

The A horizon is grayish brown (10YR 5/2) or dark grayish brown (10YR 4/2). Reaction is slightly acid or medium acid.

The B1 horizon is brown (10YR 5/3) or yellowish brown (10YR 5/4). Texture is loam or sandy clay loam, and reaction is medium acid or slightly acid. The B21t horizon is yellowish brown (10YR 5/4) or light yellowish brown (10YR 6/4). Texture is clay loam or sandy clay loam, and reaction is medium acid or slightly acid. The B22t horizon is similar to the B21t horizon in color and texture but also includes yellowish brown (10YR 5/6). Few to many, fine to coarse red, strong brown, yellowish brown, brownish yellow, or red mottles are in the B2t horizon of some pedons. Mottles are more common in the B22t horizon. Reaction is medium acid or slightly acid. The B3 horizon has coarse mottles in shades of red, brown, yellow, or gray. Reaction ranges from slightly acid to moderately alkaline.

The Cr horizon is weathered, soft, yellowish brown to yellow sandstone and has coarse gray mottles.

The Chickasha soils in this county are taxadjuncts to the Chickasha series because they are mottled in the lower part of the B2t horizon and in the B3 horizon which is not in the range described for the series; otherwise, they are similar in morphology, use, behavior, and management. In addition, the Chickasha soils in map unit Seminole, Chickasha, and Prue soils, 2 to 8 percent slopes, severely eroded, do not have a mollic epipedon.

Coweta series

The Coweta series consists of shallow, well drained, very gently sloping to strongly sloping, moderately permeable soils that formed in material weathered from sandstone. These soils are on uplands. Slopes are mainly 3 to 5 percent, but range from 2 to 12 percent.

Coweta soils are geographically closely associated with the Bates, Carytown, Dennis, Eram, Okemah, and Prue soils. Bates soils are on side slopes, are 20 to 40 inches deep over sandstone, and have a B2t horizon. Carytown, Dennis, and Okemah soils are in lower positions or in concave areas. Carytown soils have a natric horizon and Dennis and Okemah soils have an argillic horizon. These soils are more than 60 inches thick. Eram soils are on side slopes and have a fine control section, an argillic horizon, and are 20 to 40 inches deep over shale. Prue soils are in lower positions or adjacent areas. Prue soils are more than 60 inches thick and have an argillic horizon.

Typical pedon of Coweta fine sandy loam, from an area of Bates-Coweta complex, 2 to 5 percent slopes, in a pasture 3 miles north and 1 mile east of Wewoka, 1,300 feet north and 1,275 feet east of the southwest corner of sec. 33, T. 9 N., R. 8 E.:

A1—0 to 9 inches; brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

B2—9 to 14 inches; brown (7.5YR 4/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

Cr—14 to 20 inches; rippable, yellowish brown soft sandstone.

Solum thickness and depth to bedrock range from 10 to 20 inches. Reaction ranges from medium acid to neutral throughout. The content of sandstone fragments ranges from 0 to 20 percent in the A horizon and 0 to 30 percent in the B horizon.

The A1 horizon is brown (7.5YR 5/2; 10YR 5/3), dark grayish brown (10YR 4/2), or grayish brown (10YR 5/2). Texture is fine sandy loam or loam.

The B2 horizon is brown (7.5YR 4/2; 10YR 4/3), grayish brown (10YR 5/2), or dark grayish brown (10YR 4/2). Texture is loam, fine sandy loam or clay loam.

The Cr horizon is yellowish brown sandstone that can be cut with a spade in the upper few inches. Thin layers of shale are in some pedons.

The Coweta soils in this county are taxadjuncts to the Coweta series because they are slightly more alkaline in reaction and are dry for slightly longer periods than described in the range for the series. Otherwise, they are similar in morphology, use, behavior, and management.

Darnell series

The Darnell series consists of shallow, well drained, gently sloping to steep, moderately rapidly permeable soils that formed in material weathered from sandstone. These soils are on uplands. Slopes are mainly 3 to 30 percent.

Darnell soils are geographically closely associated with the Niotaze, Stephenville, and Wewoka soils. Niotaze and Stephenville soils are on side slopes of uplands. Niotaze soils have a fine control section. Stephenville soils range from 20 to 40 inches in thickness and have an argillic horizon. Wewoka soils are on ridges and range from 20 to 40 inches deep over cherty conglomerate.

Typical pedon of Darnell fine sandy loam, from an area of Stephenville-Darnell complex, 3 to 12 percent slopes, in a pasture 2 miles east and 4 miles north of the junction of Oklahoma Highway 9 and 99 north of Seminole, 2,000 feet south and 260 feet west of the northeast corner of sec. 11, T. 9 N., R. 6 E.:

A1—0 to 7 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; slightly acid; clear smooth boundary.

B21—7 to 12 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak fine granular structure; slightly hard, very friable; medium acid; clear smooth boundary.

B22—12 to 18 inches; pink (5YR 7/4) fine sandy loam, reddish yellow (5YR 6/6) moist; weak fine granular structure; slightly hard, very friable; 10 percent by volume of sandstone fragments less than 3 inches in diameter; strongly acid; clear smooth boundary.

Cr—18 to 20 inches; yellowish brown (10YR 5/4) sandstone; hard when dry; can be cut with spade when moist.

Solum thickness and depth to sandstone range from 10 to 20 inches. Reaction ranges from medium acid to neutral in the A1 horizon and from strongly acid to neutral in the B2 horizon.

The A1 or Ap horizon is grayish brown (10YR 5/2), pale brown (10YR 6/3), brown (10YR 5/3, 4/3), or light brownish gray (10YR 6/2). Texture is fine sandy loam or stony fine sandy loam. The content of sandstone fragments less than 3 inches in diameter is 0 to 10 percent by volume, and fragments ranging from 3 to 12 inches in diameter are 0 to 5 percent by volume.

The B2 horizon is pink (5YR 7/4), brown (10YR 5/3; 7.5YR 4/4, 5/4), pale brown (10YR 6/3), light yellowish brown (10YR 6/4), brownish yellow (10YR 6/6), light brown (7.5YR 6/4), very pale brown (10YR 7/4), yellow (10YR 7/6), or reddish yellow (5YR 7/6). Texture is fine sandy loam, gravelly fine sandy loam, or loam. The content of sandstone fragments is similar to the A1 horizon, but the content of those less than 3 inches in diameter is 0 to 20 percent.

The Cr horizon is weakly cemented to strongly cemented sandstone that can be cut by a spade or an auger. It is reddish brown (5YR 5/4), reddish yellow (7.5YR 6/6), strong brown (7.5YR 5/6), or yellowish brown (10YR 5/4).

Dennis series

The Dennis series consists of deep, moderately well drained, gently sloping, slowly permeable soils that formed in material weathered from shale. These soils are on uplands. Slopes are mainly 3 to 5 percent. They have a perched water table at a depth of 2 to 3 feet during winter and spring.

Dennis soils are geographically closely associated with the Bates, Carytown, Coweta, Eram, Okemah, and Prue soils. Bates and Coweta soils are on the ridges adjacent to Dennis soils. In addition, Bates soils are 20 to 40 inches deep over sandstone, and Coweta soils are less than 20 inches deep over sandstone. Carytown and Okemah soils are in lower positons or slightly concave areas. Carytown soils have a natric horizon, and Okemah soils have a dark gray surface horizon. Eram and Prue soils are on adjacent foot slopes and side slopes. Eram soils have shale bedrock at a depth of 20 to 40 inches, and Prue soils have a fine-loamy control section.

Typical pedon of Dennis loam, from an area of Dennis loam, 3 to 5 percent slopes, in a pasture 2 1/2 miles north of Wewoka, 2,000 feet north and 800 east of the southwest corner sec. 34, T. 9 N., R. 8 E.:

A1—0 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium and fine granular structure; slightly hard, friable; medium acid; clear smooth boundary.

B1—13 to 23 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable; thin clay films

on faces of peds; medium acid; gradual smooth boundary.

B21t—23 to 36 inches; brown (10YR 5/3) clay loam; brown (10YR 4/3) moist; common medium distinct light yellowish brown (10YR 6/4), brownish yellow (10YR 6/6), and dark grayish brown (10YR 4/2) mottles; moderate medium subangular blocky structure; hard, firm; nearly continuous grayish brown clay films on faces of peds; few black concretions; slightly acid; gradual smooth boundary.

B22t—36 to 48 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; many coarse prominent brownish yellow (10YR 6/6), light brownish gray (10YR 6/2), and light gray (10YR 7/2) mottles; weak medium and coarse subangular blocky structure; very hard, very firm; thin brown clay films on faces of peds; few black concretions; slightly acid; gradual smooth boundary.

B3—48 to 72 inches; coarsely mottled brownish yellow (10YR 6/6), yellowish brown (10YR 5/4), light gray (10YR 7/2), light brownish gray (10YR 6/2), and pale brown (10YR 6/3) clay; weak coarse subangular blocky structure; very hard, very firm; patchy clay films on faces of peds; slightly acid.

Solum thickness ranges from 60 to more than 72 inches. The A horizon is grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), or brown (10YR 4/3, 5/3). Reaction ranges from medium acid to neutral.

The B1 horizon is brown (10YR 4/3, 5/3) or pale brown (10YR 6/3). Reaction ranges from medium acid to mildly alkaline. The B2t horizon is dark grayish brown (10YR 4/2), light brownish gray (10YR 6/2), grayish brown (10YR 5/2), pale brown (10YR 6/3), light brown (7.5YR 6/4), brown (10YR 4/3, 5/3; 7.5YR 4/2, 4/4, 5/2, 5/4), light yellowish brown (10YR 6/4), or yellowish brown (10YR 5/4). Texture is clay, silty clay, or clay loam. Reaction ranges from slightly acid to moderately alkaline. The B3 horizon is coarsely mottled in shades of brown, gray, or yellow. Texture is clay or clay loam and ranges from slightly acid to moderately alkaline.

The Dennis soils in this county are taxadjuncts to the Dennis series because they are slightly more alkaline in reaction, depth to a horizon that has mottles of chroma of 2 is slightly deeper, and they are dry for slightly longer periods than described in the range for the series. Otherwise, they are similar in morphology, use, behavior, and management.

Dougherty series

The Dougherty series consists of deep, well drained, nearly level to strongly sloping, moderately permeable soils that formed in loamy to sandy sediment. These soils are on uplands. Slopes are mainly 0 to 8 percent.

Dougherty soils are geographically closely associated with the Eufaula, Konawa, and Teller soils. Eufaula soils are generally on the lower, steeper slopes and have a sandy control section. Konawa and Teller soils are on less sloping parts of the terrace. Konawa soils have an A horizon less than 20 inches thick. Teller soils have a mollic epipedon.

Typical pedon of Dougherty loamy fine sand, from an area of Eufaula-Dougherty complex, 3 to 12 percent slopes, in a pasture 1 mile west and 1 mile south of Konawa, 1,000 feet south and 75 feet east of northwest corner of sec. 3, T. 5 N., R. 5 E.:

A1—0 to 3 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak very fine granular structure; soft, very friable; neutral; clear smooth boundary.

A2—3 to 28 inches; light gray (10YR 7/2) loamy fine sand; light brownish gray (10YR 6/2) moist; massive; loose; slightly acid; clear smooth boundary.

B2t—28 to 44 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; hard, firm; clay films on faces of peds; strongly acid; diffuse smooth boundary.

B3—44 to 54 inches; reddish yellow (5YR 7/8) sandy clay loam, reddish yellow (5YR 6/8) moist; weak medium subangular blocky structure; hard, friable; patchy clay films on faces of peds; strongly acid; diffuse smooth boundary.

C—54 to 64 inches; reddish yellow (10YR 7/6) fine sandy loam; reddish yellow (10YR 6/6) moist; massive; hard, very friable; strongly acid.

Solum thickness ranges from 50 to more than 72 inches. The combined thickness of the A1 and A2 horizons ranges from 20 to 40 inches.

The A1 or Ap horizon is brown (7.5YR 5/3, 5/4, 4/3; 10YR 4/3, 5/3), light brownish gray (10YR 6/2), light brown (7.5YR 6/3), dark grayish brown (10YR 4/2), or grayish brown (10YR 5/2). Reaction ranges from slightly acid to strongly acid, but where the soil is limed, reaction is mildly alkaline. The A2 horizon is brown (7.5YR 5/4), light brown (7.5YR 6/4), light gray (10YR 7/2), light yellowish brown (10YR 6/4), or pale brown (10YR 6/3). Texture is loamy fine sand or fine sand. Reaction is slightly acid or medium acid.

The B2t horizon is red (2.5YR 5/6) or yellowish red (5YR 4/6, 5/6, 4/8, 5/8). Texture is usually sandy clay loam, but heavy fine sandy loam is in some pedons. Reaction ranges from slightly acid to strongly acid. The B3 horizon is red (2.5YR 5/8), yellowish red (5YR 4/6, 5/6, 4/8, 5/8), or reddish yellow (5YR 6/6, 6/8, 7/8). Texture is fine sandy loam, sandy clay loam, or loamy fine sand. Reaction ranges from slightly to strongly acid.

The C horizon is light red (2.5YR 6/8) or reddish yellow (5YR 7/6, 7/8). Texture is fine sandy loam or loamy fine sand, and reaction ranges from neutral to strongly acid.

Eram series

The Eram series consists of moderately deep, moderately well drained, gently sloping to strongly sloping, slowly permeable soils that formed in material weathered from shale. These soils are on uplands. Slopes are mainly 3 to 8 percent but range to 12 percent. A perched water table is at a depth of 2 to 3 feet during winter and spring.

Eram soils are geographically closely associated with the Bates, Carytown, Coweta, Dennis, Okemah, and Prue soils. Bates soils are on slightly higher areas and have a fine-loamy control section. Carytown, Dennis, and Okemah soils are in similar positions, but they are more than 40 inches thick. Coweta soils are on the crest of the slopes and are 10 to 20 inches deep over sandstone. Prue soils are in the same position on the landscape as Eram soils but have a fine-loamy control section and are deep over shale.

Typical pedon of Eram loam, from an area of Eram-Coweta complex, 3 to 12 percent slopes, in a pasture 5 miles south and 1/2 mile west of Wewoka, 2,000 feet east and 150 feet north of the southwest corner of sec. 18, T. 7 N., R. 8 E.:

A1—0 to 11 inches; dark grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; hard, firm; 10 percent sandstone fragments less than 3 inches across; neutral; clear smooth boundary.

B2t—11 to 22 inches; grayish brown (2.5YR 5/2) clay, dark grayish brown (2.5YR 4/2) moist; moderate medium and fine subangular blocky structure; very hard, very firm; patchy clay films on faces of peds; mildly alkaline; clear smooth boundary.

B3—22 to 30 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; few fine faint brown and light brownish gray mottles; weak medium subangular blocky structure; very hard, very firm; moderately alkaline; gradual smooth boundary.

Cr—30 to 36 inches; grayish brown (2.5Y 5/2) clay and shale, grayish brown (10YR 5/2) moist; few fine faint brown mottles; massive; very hard, very firm; moderately alkaline.

Solum thickness and depth to shale or claybeds range from 20 to 40 inches.

The A horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2; 2.5Y 5/2), brown (10YR 5/3; 7.5YR 5/2), or olive gray (5Y 5/2). Reaction is slightly acid or neutral.

The B2t horizon is grayish brown (10YR 5/2; 2.5Y 5/2), brown (10YR 5/3, 4/3; 7.5YR 5/4, 4/4), or light olive brown (2.5Y 5/4). Texture is clay loam, clay, silty clay loam, or silty clay. Reaction ranges from slightly acid to mildly alkaline. Some pedons have brown or gray mottles. The B3 horizon is grayish brown (10YR 5/2; 2.5Y 5/2), brown (10YR 5/3), pale brown (10YR 6/3), yellowish brown (10YR 5/4), light yellowish brown (10YR 6/4), or pale yellow (2.5Y 7/4). Texture is clay, silty clay, or shaly clay. Reaction ranges from neutral to moderately alkaline.

The Cr horizon is grayish brown (10YR 5/2), light brownish gray (2.5Y 6/2), yellowish brown (10YR 5/4), or very pale brown (10YR 7/4). Texture is clay, shaly clay, or shale. Reaction is mildly alkaline or moderately alkaline.

The Eram soils in this county are taxadjuncts to the Eram series because they are slightly more alkaline in reaction in the A and B2t horizons and are dry for slightly longer periods than described in the range for the series. Otherwise, they are similar in morphology, use, behavior, and management.

Eufaula series

The Eufaula series consists of deep, somewhat excessively drained, nearly level to strongly sloping, rapidly permeable soils that formed in thick, sandy sediment. These soils are on uplands. Slopes are mainly 0 to 12 percent.

Eufaula soils are geographically closely associated with the Dougherty, Konawa, and Teller soils. Dougherty and Konawa soils are mostly on lower areas of the older landscapes. Both have a fine-loamy control section. Teller soils are on less sloping areas and have a mollic epipedon.

Typical pedon of Eufaula fine sand, from an area of Eufaula-Dougherty complex, 3 to 12 percent slopes, in a pasture 1 mile west and 1 1/4 miles south of Konawa, 1,000 feet south and 75 feet east of the northwest corner of sec. 3, T. 5 N., R. 5 E.:

A1—0 to 3 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; weak very fine granular structure; soft, very friable; neutral; clear smooth boundary.

A21—3 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; single grain; loose; medium acid; clear smooth boundary.

A22&B2t—60 to 80 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist (A22); single grain; loose; with lamellae of yellowish red (5YR 4/6) loamy fine sand (B2t); the lamellae are massive; slightly hard, very friable; wavy and discontinuous 1/8 to 1/2 inch thick and 2 to 4 inches apart; the lamellae have clay bridges between the sand grains; medium acid.

Solum thickness is more than 72 inches. Reaction of all horizons ranges from medium acid to neutral.

The A1 or Ap horizon is light brown (7.5YR 6/4), grayish brown (10YR 5/2), light brownish gray (10YR 6/2), brown (10YR 5/3), pale brown (10YR 6/3), very pale brown (10YR 7/3), or light yellowish brown (10YR 6/4). Texture is loamy fine sand or fine sand. The A21 is

brown (7.5YR 5/4), light brown (7.5YR 6/4), reddish yellow (7.5YR 6/6), light gray (10YR 7/2), pale brown (10YR 6/3), very pale brown (10YR 7/3, 7/4), reddish brown (5YR 4/4, 5/4), light reddish brown (5YR 6/4), or pink (5YR 7/4). Texture is fine sand or loamy fine sand. Depth to lamellae or to a continuous B horizon ranges from about 30 to 60 inches. The A22 is light yellowish brown (10YR 6/4), very pale brown (10YR 7/3, 7/4), light reddish brown (5YR 6/4), or pink (5YR 7/4). Texture is fine sand or loamy fine sand.

The B2t horizon that is horizontally and vertically continuous is less common than the B2t horizon of lamellae. The lamellae are 1/8 to 1 inch thick and occasionally up to 2 inches thick. The B2t horizon is yellowish red (5YR 4/6, 5/6), reddish yellow (5YR 6/6, 6/8, 7/6), or red (2.5YR 4/6). Texture of the lamellae is fine sandy loam or loamy fine sand. Texture of the continuous B2t horizon is loamy fine sand.

Soils that have hue of 5YR in the A1 horizon were considered to be Eufaula soils in naming the map units. These soils are enough like the Eufaula soils in other characteristics and behavior that nothing would be gained by adding another series name.

Gaddy series

The Gaddy series consists of deep, somewhat excessively drained, nearly level to very gently undulating, rapidly permeable soils that formed in sandy, calcareous alluvial sediment. These soils are mainly on broad flood plains of the major streams and are near the river channel. Slopes are mainly less than 1 percent but range up to 2 percent for short distances along old river channels.

Gaddy soils are geographically closely associated with the Asher, Gracemore, Keokuk, and Yahola soils. Asher and Keokuk soils are on higher flood plains and have fine-silty control sections. Gracemore soils are on a lower position near the stream channel and are somewhat poorly drained. Yahola soils generally are further from the stream than Gaddy soils and have a coarse-loamy control section.

Typical pedon of Gaddy loamy fine sand, in a pasture 1 mile north of the junction of Interstate 40 and Oklahoma Highway 99 north of Seminole, 2,600 feet north and 750 feet east of the southwest corner of sec. 27, T. 11 N., R. 6 E.:

A1—0 to 8 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

C1—8 to 30 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; single grain; soft, very friable; common thin strata of fine sand, fine sandy loam, and loamy very fine sand that are 1/4 inch to 3 inches thick; calcareous; moderately alkaline; clear smooth boundary.

C2—30 to 60 inches; pink (7.5YR 7/4) fine sand, light brown (7.5YR 6/4) moist; single grain; loose dry and moist; common thin strata of loamy fine sand, fine sandy loam, and loamy very fine sand that are 1/4 inch to 6 inches thick; calcareous; moderately alkaline.

The upper few inches of the soil are slightly darkened by organic matter, but the content is less than 1 percent. Below this is relatively unaltered alluvium.

The A1 or Ap horizon is brown (10YR 5/3; 7.5YR 5/4), light brown (7.5YR 6/4), or pale brown (10YR 6/3). Reaction is mildly alkaline or moderately alkaline. Some pedons are calcareous.

The C horizon is light yellowish brown (10YR 6/4), light brown (7.5YR 6/4), pink (7.5YR 7/4), or very pale brown (10YR 7/3, 7/4). Texture is loamy fine sand to a depth of 30 inches and loamy fine sand or fine sand below 30 inches with thin strata of fine sandy loam, loamy very fine sand, and fine sand.

Gowton series

The Gowton series consists of deep, well drained, nearly level, moderately permeable soils that formed in loamy alluvial sediment. These soils are on narrow to broad flood plains of small creeks. Slopes are mainly less than 1 percent.

Gowton soils are geographically closely associated with the Madill, Tullahassee, and Wynona soils. Madill and Tullahassee soils have a more sandy control section. In addition, the Tullahassee soils have a perched water table at a depth of 2 to 3 feet during winter and spring. Wynona soils have a fine-silty control section and a perched water table within 2 feet of the soil surface.

Typical pedon of Gowton loam, in a pasture along Coon Creek, 6 miles north and 1 mile west of Wewoka, about 1,550 feet east and 650 feet north of the southwest corner of sec. 13, T. 9 N., R. 7 E.:

A11—0 to 12 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate medium granular structure; hard, friable; few earthworm casts; slightly acid; clear smooth boundary.

A12—12 to 28 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; moderate medium granular structure; very hard, friable; few earthworm casts; slightly acid; diffuse smooth boundary.

A13—28 to 42 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; common fine faint yellowish brown mottles; moderate medium subangular blocky structure; very hard, friable; many earthworm casts; slightly acid; gradual smooth boundary.

C1—42 to 60 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; many fine faint yellowish brown mottles; massive; very hard, friable; common earthworm casts; few black

bodies; few thin strata of silt loam and loam; slightly acid; diffuse smooth boundary.

C2—60 to 80 inches; brownish yellow (10YR 6/6) clay loam, yellowish brown (10YR 5/6) moist; many medium distinct pale brown (10YR 6/3) mottles; massive; very hard, friable; few black bodies; few thin strata of silt loam and loam; mildly alkaline.

Thickness of the mollic epipedon ranges from 24 to 45 inches. The A11 and A12 horizons are dark gray (10YR 4/1), dark grayish brown (10YR 4/2), gray (10YR 5/1), grayish brown (10YR 5/2), or brown (10YR 5/3). Texture is loam or clay loam, and reaction ranges from medium acid to neutral. The A13 horizon is not always present. Where present, it is similar to the C horizon in color and texture. Reaction ranges from medium acid to neutral.

The C horizon is light yellowish brown (10YR 6/4), brownish yellow (10YR 6/6), grayish brown (10YR 5/2), gray (10YR 5/1), yellowish brown (10YR 5/4), brown (10YR 5/3), or pale brown (10YR 6/3). Texture is clay loam or loam and is stratified with fine sandy loam, clay loam, or gravelly loam. Reaction ranges from slightly acid to moderately alkaline. Common or many, small and medium distinct gray (10YR 5/1), grayish brown (10YR 5/2), dark yellowish brown (10YR 4/4), pale brown (10YR 6/3), or yellowish brown (10YR 5/8) mottles are in most pedons.

Soils that have slightly less than 15 percent fine or coarser sand in the control section were considered Gowton soils in naming the map units. Their behavior is similar enough to the Gowton soils that nothing would be gained by adding another series name.

Gracemont series

The Gracemont series consists of deep, somewhat poorly drained, moderately rapidly permeable soils that formed in predominantly loamy alluvial sediment. These soils are on flood plains of the major streams and are near the stream channel. They have an apparent water table at a depth of 1/2 foot to 3 feet during spring and summer. Slopes are plane or slightly undulating.

Gracemont soils are geographically closely associated with the Harjo, Roebuck, and Yahola soils. Harjo and Roebuck soils are further from the stream channel and have a fine control section. Yahola soils are where the stream channel is deeper, which allows for better drainage. They do not have a high water table.

Typical pedon of Gracemont fine sandy loam, in a pasture about 9 miles north of Konawa, 1,200 feet south and 400 feet west of the northeast corner of sec. 1, T. 7 N., R. 5 E.:

A1—0 to 10 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; few fine strata of loam and very fine sandy loam; calcareous; moderately alkaline; clear smooth boundary.

C1—10 to 80 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; massive; slightly hard, very friable; common thin strata of loam, clay loam, and loamy fine sand; calcareous; moderately alkaline.

The A horizon is mildly alkaline or moderately alkaline and may or may not be calcareous. The C horizon is calcareous and moderately alkaline. The A horizon is reddish brown (5YR 5/3, 5/4), light reddish brown (5YR 6/4), reddish yellow (5YR 6/6; 7.5YR 6/6), brown (7.5YR 5/4; 10YR 5/3), or light brown (7.5YR 6/4).

The C horizon is reddish brown (5YR 5/3, 5/4, 4/4), light reddish brown (5YR 6/4), reddish yellow (5YR 6/6, 6/8; 7.5YR 6/6, 7/6), yellowish red (5YR 5/6), or red (2.5YR 5/6, 4/6). Texture of this horizon averages fine sandy loam, but there are strata that have finer or coarser textures.

Buried soils are in some pedons below 30 inches. They usually have a hue of 7.5YR or 10YR, chroma of 1 or 2, and value of 2 and 3 moist.

Gracemore series

The Gracemore series consists of deep, somewhat poorly drained, undulating, moderately rapidly permeable soils that formed in predominantly sandy alluvial sediment. These soils are on flood plains nearer the stream channel. They have an apparent water table at a depth of 1/2 foot to 3 feet during spring and summer. Slopes are mainly less than 1 percent.

Gracemore soils are geographically closely associated with the Asher, Gaddy, Keokuk, and Yahola soils. All of the associated soils are higher in elevation on the flood plain and do not have a high water table. In addition, the Keokuk soils have a coarse-silty control section, the Asher soils have a fine-silty control section, and the Yahola soils have a coarse-loamy control section.

Typical pedon of Gracemore loamy fine sand, in a pasture 5 miles south and 3 miles east of Konawa, 2,600 feet east and 450 north of the southwest corner sec. 29, T. 5 N., R. 6 E.:

A1—0 to 9 inches; light reddish brown (5YR 6/4) loamy fine sand, reddish brown (5YR 5/4) moist; weak fine granular structure; soft, very friable; calcareous; moderately alkaline; clear smooth boundary.

C—9 to 60 inches; pink (7.5YR 7/4) loamy fine sand, light brown (7.5YR 6/4) moist; single grain; loose, very friable; common thin strata of fine sand and fine sandy loam that range from 1/8 to 1 inch thick; calcareous; moderately alkaline.

These soils are moderately alkaline and calcareous throughout the 10- to 40-inch control section. The A horizon is light reddish brown (5YR 6/4) or pale brown (10YR 6/3). Reaction is mildly alkaline or moderately alkaline and may be calcareous. The C horizon is pink

(7.5YR 7/3, 7/4). It is stratified with finer or coarser textures that are 1/8 inch to 3 inches thick.

Grainola series

The Grainola series consists of moderately deep, well drained, gently sloping to strongly sloping, slowly permeable soils that formed in material weathered from shale. These soils are on uplands. Slopes are mainly 3 to 12 percent.

Grainola soils are geographically associated with the Aydelotte, Chickasha, Lucien, Seminole, and Waurika soils. The Aydelotte and Seminole soils are on less sloping areas and have a fine control section. Chickasha soils are on less sloping areas and have fine-loamy control section. Lucien soils are on ridge crests and are less than 20 inches thick. Waurika soils are on concave areas, are deeper, and are somewhat poorly drained.

Typical pedon of Grainola clay loam, from an area of Grainola-Lucien complex, 3 to 12 percent slopes, in a pasture 4 miles west and 2 miles north of the junction of Oklahoma Highways 9 and 99 in Seminole, 2,200 feet north and 2,000 feet west of southeast corner of sec. 2, T. 9 N., R. 5 E.:

A1—0 to 4 inches; reddish brown (5YR 5/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate coarse granular structure; hard, firm; moderately alkaline; gradual smooth boundary.

B1—4 to 14 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; very hard, firm; calcareous; moderately alkaline; gradual smooth boundary.

B2t—14 to 24 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; moderate medium subangular blocky structure; very hard, very firm; patchy clay films on faces of peds; calcareous; moderately alkaline; gradual smooth boundary.

B3—24 to 36 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; weak coarse subangular blocky structure; very hard, very firm; few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.

Cr—36 to 50 inches; reddish brown (2.5YR 5/4) shale bedrock; laminated; calcareous; moderately alkaline.

Solum thickness and depth to soft siltstone or shale range from 20 to 40 inches. Some pedons have up to 35 percent sandstone or chert fragments, mostly less than 3 inches in diameter. During summer, this soil cracks as much as 1/2 inch in width and 20 inches in depth. Reaction is mildly alkaline or moderately alkaline, and some pedons are calcareous in the A1 horizon. Reaction is moderately alkaline and calcareous in the B and C horizons.

The A1 horizon is reddish gray (5YR 5/2) or reddish brown (5YR 5/4). Texture is silty clay loam or clay loam.

The B1 horizon is reddish brown (5YR 5/3, 5/4) or reddish gray (5YR 5/2). Texture is clay, silty clay, silty clay loam, or clay loam. The B2t horizon is reddish brown (5YR 5/3, 5/4; 2.5YR 5/4), and texture is clay or silty clay. The B3 horizon is similar to the B2t horizon but has a weaker grade of structure.

The Cr horizon is reddish brown shale or siltstones interbedded with thin strata of sandy shale.

Soils that have a neutral reaction in the B1 and B2 horizons were considered Grainola soils in naming the map units. Their behavior is similar enough to the Grainola soils that nothing would be gained by adding another series name.

Harjo series

The Harjo series consists of deep, poorly drained, nearly level, very slowly permeable soils that formed in clayey alluvial sediment. These soils are on broad flood plains. They have an apparent water table within a depth of 1 foot most of the year. Slopes are less than 1 percent. The stream channel is higher than this soil in many areas, making gravity-flow drainage nearly impossible.

Harjo soils are geographically closely associated with the Gracemont, Roebuck, and Yahola soils. Gracemont and Yahola soils are on a higher level nearer the channel and have a coarse-loamy control section. Roebuck soils are on higher levels than the Harjo soils and are better drained.

Typical pedon of Harjo clay, in a pasture 9 miles north of Konawa, 1,500 feet south and 500 feet west of the northeast corner of sec. 15, T. 7 N., R. 5 E.:

A1—0 to 9 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; weak medium platy structure parting to weak medium and coarse granular in the upper 2 inches and weak or moderate medium or fine angular or subangular blocky in lower part; extremely hard, very firm; calcareous; moderately alkaline; clear smooth boundary.

C1—9 to 60 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; weak to moderate medium and fine angular and subangular blocky structure; extremely hard, very firm; few thin strata of loam and very fine sandy loam about 1/2 inch to 2 inches thick; calcareous; moderately alkaline; clear smooth boundary.

C2—60 to 80 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; massive; very hard, very firm; common thin strata of yellowish red (5YR 5/6) fine sandy loam, loam, and very fine sandy loam; calcareous; moderately alkaline.

Thickness of the clayey soil material is 60 inches or more. Buried horizons are in some pedons.

The A horizon is reddish brown (2.5YR 5/4, 5YR 5/4), red (2.5YR 4/6, 5/6), or yellowish red (5YR 5/6). Reaction is mildly alkaline or moderately alkaline.

The C horizon has the same range in color as the A horizon. Texture is clay or clay loam with thin strata of fine sandy loam, very fine sandy loam, or loam. Some pedons have stratified loamy sediment below the control section.

Keokuk series

The Keokuk series consists of deep, well drained, nearly level, moderately permeable soils that formed in silty and loamy alluvial sediments. They are mainly on broad flood plains of the major rivers. Slopes are less than 1 percent.

Keokuk soils are geographically closely associated with the Asher, Gaddy, Gracemore, and Yahola soils. Asher soils are at the same elevation on the flood plain but are farthest from the river channel. In addition, Asher soils have a fine-silty control section. The Gaddy, Gracemore, and Yahola soils are at lower elevations on the flood plains nearer the stream. The Gaddy and Gracemore soils have a sandy control section, while Yahola soils have a coarse-loamy control section.

Typical pedon of Keokuk silt loam, in a cultivated field 6 miles west and 1 mile north of the junction of Oklahoma Highway 99 and Interstate 40, 2,600 feet south and 800 feet east of the northwest corner of sec. 27, T. 11 N., R. 5 E.:

A1—0 to 16 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine granular structure; hard, friable; slightly acid; gradual smooth boundary.

B2—16 to 24 inches; brown (10YR 5/3) silt loam, brown (10YR 4/3) moist; moderate medium and fine granular structure; hard, friable; neutral; gradual wavy boundary.

C1—24 to 60 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) moist; slightly hard, very friable; few thin strata of finer and coarser textures; calcareous; moderately alkaline.

Solum thickness and depth to secondary carbonates range from 24 to 30 inches. The A horizon is grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), or brown (10YR 5/3). Reaction is slightly acid or neutral.

The B horizon is reddish brown (5YR 5/4), brown (10YR 5/3), or light yellowish brown (10YR 6/4). Texture is loam, silt loam, or very fine sandy loam. Reaction is slightly acid or neutral.

The C horizon is pale brown (10YR 6/3), very pale brown (10YR 7/4), or pink (7.5YR 7/4). Texture is silt loam, very fine sandy loam, or loam. Reaction is moderately alkaline and calcareous. A few thin strata of finer and coarser textures are in this horizon.

Konawa series

The Konawa series consists of deep, well drained, nearly level to gently sloping, moderately permeable soils that formed in loamy sediment. These soils are on uplands. Slopes are mainly 0 to 5 percent.

Konawa soils are geographically closely associated with the Dougherty, Eufaula, and Teller soils. Dougherty soils are in the same position on the landscape but have an A horizon that ranges from 20 to 40 inches in thickness. Eufaula soils are generally on more rolling topography and have a sandy control section. Teller soils are in the same position on the landscape, but they formed under prairie vegetation and have a mollic epipedon.

Typical profile of Konawa fine sandy loam, from an area of Konawa fine sandy loam, 3 to 5 percent slopes, in a pasture 2 miles east and 3 miles north of Maud, 1,800 feet west and 1,300 feet south of the northeast corner sec. 14, T. 8 N., R. 5 E.:

A1—0 to 4 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; slightly acid; clear smooth boundary.

A2—4 to 16 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; single grain; loose, very friable; slightly acid; clear smooth boundary.

B21t—16 to 36 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak fine and medium subangular blocky structure; very hard, friable; clay films on faces of peds and clay bridges between sand grains; medium acid; diffuse smooth boundary.

B22t—36 to 50 inches; yellowish red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) moist; weak coarse subangular blocky structure; hard, friable; clay bridges between sand grains; medium acid; diffuse smooth boundary.

B3—50 to 60 inches; reddish yellow (5YR 6/8) fine sandy loam, yellowish red (5YR 5/8) moist; weak coarse subangular blocky structure; hard, friable; patchy clay films on faces of peds; medium acid.

Solum thickness ranges from 54 to more than 72 inches. The A horizon is less than 20 inches thick.

The A1 or Ap horizon is grayish brown (10YR 5/2), brown (10YR 5/3), or pale brown (10YR 6/3). The A1, Ap, or A2 horizon is medium acid or slightly acid, but it is neutral where limed. In the vicinity of the town of Konawa, many pedons are mildly alkaline due to the lime drift from the cement plant at Ada. The A2 horizon is brown (7.5YR 5/4), light brown (7.5YR 6/4), pale brown (10YR 6/3), light yellowish brown (10YR 6/4) or very pale brown (10YR 7/4). Texture is fine sandy loam or rarely loamy fine sand.

The B2t horizon is reddish brown (5YR 4/4, 5/4), red (2.5YR 5/6), light red (2.5YR 6/6), yellowish red (5YR 5/6,

5/8), or reddish yellow (5YR 6/6, 6/8). Texture is fine sandy loam or sandy clay loam, and reaction is medium acid or strongly acid. The B3 horizon has the same range in color as the B2t horizon. Texture is fine sandy loam or sandy clay loam, and reaction ranges from strongly acid to neutral.

The C horizon, which is in some pedons, is fine sandy loam or loamy fine sand, and reaction ranges from strongly acid to neutral. Colors are similar to those in the B2t horizon.

Lucien series

The Lucien series consists of shallow, well drained, gently sloping to strongly sloping, moderately radidly permeable soils that are formed in loamy material weathered from sandstone. These soils are on uplands. Slopes are generally 3 to 8 percent but range up to 12 percent.

Lucien soils are geographically closely assoicated with the Aydelotte, Chickasha, Grainola, Seminole, and Waurika soils. Aydelotte soils are more than 60 inches thick and are on higher areas. Chickasha soils are gently sloping and are deep over sandstone. Grainola soils are on lower slopes and are clayey soils that are moderately deep over shale. Seminole soils are on higher areas and have a natric horizon. Waurika soils have gentler slopes and are more clayey and deeper.

Typical pedon of Lucien loam, from an area of Grainola-Lucien complex, 3 to 12 percent slopes, in a pasture about 2 miles west and 2 miles north of the junction of Oklahoma Highways 3 and 9 northwest of Seminole, 2,000 feet north and 2,000 feet west of the southeast corner of sec. 2, T. 9 N., R. 5 E.:

A1—0 to 4 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate fine and very fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

B2—4 to 12 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; moderate fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

Cr—12 to 14 inches; brown (7.5YR 5/4) soft sandstone; slightly acid.

The solum thickness and depth to sandstone range from 10 to 20 inches. Reaction is neutral or slightly acid.

The A horizon is brown (7.5YR 4/2, 5/2; 10YR 5/3) loam but includes fine sandy loam. As much as 20 percent of the surface is covered with sandstone fragments that are up to 12 inches in diameter. The B2 horizon is brown (7.5YR 4/2, 5/4; 10YR 5/3) loam or fine sandy loam. As much as 10 percent sandstone fragments less than 3 inches in diameter are in some pedons. The C horizon is brown soft sandstone, and reaction ranges from slightly acid to moderately alkaline.

The Lucien soils have hue of 10YR, which is not characteristic of the Lucien series. Otherwise, they are similar in morphology, use, behavior, and management, and little would be gained by adding another series name.

Madill series

The Madill series consists of deep, well drained, nearly level, moderately rapidly permeable soils that formed in loamy or sandy alluvium. These soils are on flood plains of local streams. Slopes are generally less than 1 percent.

Madill soils are geographically closely associated with the Gowton, Tullahassee, and Wynona soils. Gowton soils are on the same flood plain and have developed a mollic epipedon. Tullahassee soils are also on the same flood plain but have an apparent water table at a depth of 2 to 3 feet during winter and spring. Wynona soils are on similar areas but have a perched water table within 2 feet of the surface.

Typical pedon of Madill fine sandy loam, from an area of Madill fine sandy loam, in a pasture about 4 miles south and 1 mile west of Bowlegs, 1,250 feet south and 1,350 feet west of the northeast corner of sec. 17, T. 7 N., R. 6 E.:

A1—0 to 10 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak fine granular structure; hard, very friable; slightly acid; clear smooth boundary.

C1—10 to 42 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; massive; slightly hard, very friable; common thin strata of finer or coarser textures; neutral; clear smooth boundary.

Ab1—42 to 52 inches; dark reddish brown (5YR 3/2) loam, dark reddish brown (5YR 2/2) moist; massive; hard, friable; moderately alkaline; clear smooth boundary.

Ab2—52 to 60 inches; reddish brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; common medium distinct reddish yellow (5YR 6/6) mottles; massive; very hard, friable; moderately alkaline.

The reaction ranges from medium acid to neutral in the upper 40 inches and from slightly acid to moderately alkaline below 40 inches. The A horizon is brown (10YR 5/3; 7.5YR 5/4) or grayish brown (10YR 5/2). The C horizon is brown (7.5YR 4/4; 10YR 5/3), light brown (7.5YR 6/4), light yellowish brown (10YR 6/4), or reddish yellow (7.5YR 6/6). Texture is fine sandy loam with few to common thin strata of finer or coarser textures.

Many pedons have buried horizons below 40 inches. Texture of these horizons is loam or silt loam, and they are very dark brown (10YR 2/2), black (10YR 2/1), dark reddish brown (5YR 3/2), or reddish brown (5YR 4/3).

The Madill soils have reddish yellow mottles in the lower part of the profile, which is not characteristic of the Madill series. Otherwise, they are similar in morphology, use, behavior, and management, and little would be gained by adding another series name.

Newtonia series

The Newtonia series consists of deep, well drained, very gently sloping, moderately permeable soils that formed in material weathered from limestone. They are on uplands. Slopes are mainly 1 to 3 percent.

Newtonia soils are geographically closely associated with the Catoosa and Shidler soils. Catoosa soils are moderately deep over limestone and are higher on the ridges or nearer the escarpment. Shidler soils are shallow over limestone, are near the escarpments, and are on the ridgetops.

Typical pedon of Newtonia silt loam, from an area of Newtonia-Catoosa complex, 1 to 3 percent slopes, in a pasture about 5 miles south and 3 miles west of Wewoka, 1,700 feet north and 1,750 feet east of the southwest corner of sec. 11, T. 7 N., R. 7 E.:

A1—0 to 10 inches; reddish brown (5YR 5/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

B1—10 to 16 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; hard, friable; patchy clay films on faces of peds; neutral; clear smooth boundary.

B21t—16 to 40 inches; yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; very hard, friable; nearly continuous clay films on faces of peds; few fine chert fragments; common fine black bodies; few black concretions; medium acid; gradual smooth boundary.

B22t—40 to 52 inches; yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure parting to weak coarse subangular blocky in the lower part; very hard, firm; nearly continuous clay films on faces of peds; few fine chert fragments in horizontal bands between 40 and 48 inches wide; many fine black bodies and concretions; medium acid; clear smooth boundary.

IIB—52 to 61 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse subangular blocky structure; very hard, friable; patchy clay films on faces of peds; few fine sandstone fragments, mostly in lower part; slightly acid; clear smooth boundary.

IICr—61 to 70 inches; yellowish brown (10YR 5/6) soft slightly weathered sandstone.

Solum thickness and depth to bedrock are more than 60 inches. The A1 or Ap horizon is dark reddish gray (5YR 4/2), reddish gray (5YR 5/2), reddish brown (5YR 5/3), brown (7.5YR 4/2, 5/3), or dark grayish brown (10YR 4/2). Reaction is slightly acid or neutral.

The B1 horizon is dark reddish gray (5YR 4/2), reddish gray (5YR 5/2), reddish brown (5YR 4/4, 5/3, 5/4), brown (7.5YR 5/4), or dark grayish brown (10YR 4/2). Texture is silty clay loam or silt loam, and reaction ranges from medium acid to neutral. The B2t horizon is reddish brown (5YR 4/3, 4/4, 5/4), reddish yellow (5YR 6/6), or yellowish red (5YR 5/6, 4/6). Reaction ranges from medium acid to moderately alkaline. The IIB3 horizon is reddish brown (5YR 5/4), light reddish brown (5YR 6/4), yellowish red (5YR 5/6, 4/6), or brown (7.5YR 5/4). Reaction ranges from slightly acid to moderately alkaline.

The IICr horizon is usually soft, weathered sandstone but is limestone or shale in some pedons.

The Newtonia soils in this county are taxadjuncts to the Newtonia series because they are slightly more alkaline in reaction in the A and B1 horizons and have a lower silt content than described in the range for the series. Otherwise, they are similar in morphology, use, behavior, and management.

Niotaze series

The Niotaze series consists of moderately deep, somewhat poorly drained, gently sloping to steep, slowly permeable soils that formed in material weathered from shales. These soils are on uplands. Slopes are mainly 5 to 12 percent but range from 3 to 30 percent. They have a perched water table at a depth of 1 foot to 2 feet during winter and spring.

Niotaze soils are geographically closely associated with the Darnell, Stephenville, and Wewoka soils. Darnell soils generally are on the crest of the slopes and above sandstone outcrops. They have a loamy control section and are shallow over sandstone. Stephenville soils are on similar areas, but they have a fine-loamy control section. Wewoka soils are on ridge crests and are less clayey.

Typical pedon of Niotaze stony fine sandy loam, from an area of Niotaze-Darnell complex, 8 to 30 percent slopes, in a wooded area about 1 mile west and 2 miles south of Wewoka, 900 feet north and 50 feet east of the southeast corner of sec. 30, T, 8 N., R. 8 E.:

A1—0 to 5 inches; brown (10YR 4/3) stony fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; 5 percent sandstone fragments greater than 10 inches in diameter; 10 percent sandstone fragments from 3 to 10 inches in diameter; strongly acid; clear smooth boundary.

A2—5 to 10 inches; light yellowish brown (10YR 6/4) stony fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; slightly hard, very friable; 5 percent sandstone fragments greater than 10 inches in diameter; 10 percent sandstone fragments from 3 to 10 inches in diameter; strongly acid; abrupt smooth boundary.

IIB2t—10 to 22 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; few fine distinct grayish brown and gray mottles; moderate medium subangular blocky structure; very hard, firm; nearly continuous clay films on faces of peds; strongly acid; clear smooth boundary.

IIB3—22 to 32 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; common fine distinct grayish brown and gray mottles; weak medium and coarse subangular blocky structure; very hard, firm; patchy clay films on faces of peds; strongly acid; gradual smooth boundary.

IIC—32 to 45 inches; brown, weakly laminated shale; neutral.

Thickness of the solum and depth to shale range from 20 to 40 inches. In some pedons, up to 1 inch of organic litter is on top of the mineral surface.

The A1 horizon is grayish brown (10YR 5/2), light grayish brown (10YR 6/2), brown (10YR 4/3, 5/3), or pale brown (10YR 6/3). Texture is fine sandy loam, gravelly fine sandy loam, cobbly fine sandy loam, or stony fine sandy loam. Sandstone fragments that are more than 10 inches in diameter make up 0 to 5 percent by volume, those that range from 3 to 10 inches in diameter make up 5 to 25 percent by volume, and those that are less than 3 inches in diameter make up 5 to 20 percent by volume. Reaction is medium acid or strongly acid. The A2 horizon is very pale brown (10YR 7/3, 7/4), light yellowish brown (10YR 6/4), or pink (7.5YR 7/4). The texture, reaction, and content of coarse sandstone fragments are similar to the A1 horizon.

The IIB2t horizon is light yellowish brown (10YR 6/4), yellowish brown (10YR 5/4), brown (10YR 5/3), brownish yellow (10YR 6/6), reddish yellow (7.5YR 6/6), reddish brown (5YR 5/4; 2.5YR 5/4), or yellowish red (5YR 5/8). Mottles are in shades of brown or gray. Texture is clay or clay loam, and reaction ranges from slightly acid to very strongly acid. Sandstone fragments less than 3 inches in diameter make up from 0 to 10 percent by volume.

The IIB3 horizon is pale brown (10YR 6/3), light yellowish brown (10YR 6/4), brownish yellow (10YR 6/6), or brown (10YR 5/3). Mottles are in shades of brown or gray. Texture is clay or shaly clay, and reaction ranges from neutral to strongly acid. Shale fragments less than 3 inches in diameter make up from 0 to 50 percent by volume.

The IICr horizon is brown, weakly laminated shale or massive clay, and reaction ranges from medium acid to neutral.

Okemah series

The Okemah series consists of deep, moderately well drained, nearly level to very gently sloping, slowly permeable soils that formed in material weathered from shale. They are on broad uplands. Slopes are generally 0 to 1 percent but range from 0 to 3 percent. These soils have a perched water table at a depth of 2 to 3 feet during winter and spring.

Okemah soils are geographically closely associated with the Bates, Carytown, Coweta, Dennis, Eram, and Prue soils. Bates soils generally are on ridges and are moderately deep over sandstone. Carytown soils are on concave areas and have a natric horizon. Coweta soils are on ridge crests and are less than 20 inches deep to bedrock. Dennis soils are on similar areas but have a higher chroma in the lower part of the argillic horizon. Eram soils are on side slopes and range from 20 to 40 inches deep over bedrock. The Prue soils are on more sloping landscapes and have a fine-loamy control section.

Typical pedon of Okemah silt loam, from an area of Okemah silt loam, 0 to 1 percent slopes, in a pasture about 2 miles north and 1 mile east of Wewoka, 1,300 feet west and 100 feet north of the southeast corner of sec. 5, T. 8 N., R. 8 E.:

A1—0 to 15 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate fine granular structure; slightly hard, friable; mildly alkaline; clear smooth boundary.

B1—15 to 20 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

B21t—20 to 36 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; few fine distinct dark yellowish brown mottles; moderate medium subangular blocky structure; very hard, very firm; nearly continuous very dark gray (10YR 3/1) clay films on faces of peds; neutral; gradual smooth boundary.

B22t—36 to 60 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; few fine distinct yellowish brown and light grayish brown mottles; weak medium subangular blocky structure; extremely hard, very firm; nearly continuous dark gray clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B3—60 to 80 inches; light yellowish brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; many coarse distinct yellowish brown (10YR 5/6), light gray (10YR 7/2), and light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; extremely hard, extremely firm; patchy gray and dark gray clay films on faces of peds; few fine black bodies; moderately alkaline.

The solum is more than 60 inches thick. Thickness of the A1 and B1 horizons ranges from 18 to 29 inches. The A1 horizon is dark gray (10YR 4/1) or gray (10YR 5/2) and is slightly acid to mildly alkaline.

The B1 horizon is dark gray (10YR 4/1) or gray (10YR 5/2), and reaction ranges from medium acid to neutral.

The B21t horizon is grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), or gray (10YR 5/1) and has dark yellowish brown mottles. Reaction ranges from medium acid to neutral. The B22t horizon is grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), and has coarse mottles. Mottles are yellowish brown, brownish yellow, light grayish brown, grayish brown, and gray. Reaction ranges from slightly acid to mildly alkaline. The B3 horizon is pale brown (10YR 6/3) or light yellowish brown (10YR 6/4) and has many coarse mottles. Mottles are yellowish brown, brownish yellow, light gray, light brownish gray, grayish brown, or gray. Reaction ranges from neutral to moderately alkaline.

The Okemah soils in this county are taxadjuncts to the Okemah series because the A and B1 horizons are slightly more alkaline in reaction and are dry for slightly longer periods of time than described in the range for the series. Otherwise, they are similar in morphology, use, behavior, and management.

Prue series

The Prue series consists of deep, moderately well drained, very gently sloping to sloping, moderately slowly permeable soils that formed in material weathered from interbedded sandstone and shale. These soils are on foot slopes of uplands. Slopes are 1 to 8 percent.

Prue soils are geographically closely associated with the Bates, Carytown, Coweta, and Eram soils and are adjacent to Dennis and Okemah soils. Bates are on broad ridges, have a fine-loamy control section, and are moderately deep over sandstone. Carytown soils are on toe slopes and have a natric horizon. Eram soils are on side slopes, have a mollic epipedon, and are moderately deep over shale. Dennis and Okemah soils have a fine control section.

Typical pedon of Prue loam, from an area of Prue loam, 3 to 5 percent slopes, in a pasture about 6 miles south and 1 mile west of Wewoka, 1,500 feet west and 35 feet north of the southeast corner of sec. 13, T, 7 N., R. 7 E.:

A1—0 to 20 inches; dark grayish brown (10YR 4/2) loam; very dark brown (10YR 2/2) moist; moderate medium and fine granular structure; slightly hard, friable; slightly acid; clear smooth boundary.

B1—20 to 30 inches; dark grayish brown (10YR 4/2) loam; very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, friable; patchy clay films on faces of peds; medium acid; gradual smooth boundary.

B21t—30 to 44 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; common fine distinct yellowish brown and light yellowish brown mottles; moderate medium subangular blocky structure; hard, firm; nearly continuous clay films on faces of peds, some grayish brown (10YR 5/2); common worm casts; slightly acid; gradual smooth boundary.

IIB22t—44 to 56 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; many medium prominent brownish yellow (10YR 6/6), light brownish gray (10YR 6/2), and light brown (7.5YR 6/4) mottles; moderate medium subangular blocky structure; very hard, very firm; patchy clay films on faces of peds, some grayish brown; neutral; diffuse smooth boundary.

IIB3—56 to 72 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; many coarse prominent brownish yellow (10YR 6/6), light yellowish brown (10YR 6/4), light grayish brown (10YR 6/2), and light gray (10YR 6/1) mottles; weak coarse subangular blocky structure; very hard, very firm; patchy clay films on faces of peds; neutral.

Solum thickness and depth to bedrock are more than 60 inches. The A1 horizon is dark gray (10YR 4/1), dark grayish brown (10YR 4/2), or grayish brown (10YR 5/2). Reaction ranges from medium acid to neutral.

The B1 horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), brown (10YR 5/3), or pale brown (10YR 6/3). Texture is loam, clay loam, or sandy clay loam. Reaction ranges from medium acid to neutral. The B21t horizon is brown (10YR 5/3), yellowish brown (10YR 5/4), light yellowish brown (10YR 4/6), or pale brown (10YR 6/3). Mottles are in shades of brown or red. Texture is clay loam or sandy clay loam with about 25 to 35 percent content of clay. Reaction ranges from medium acid to mildly alkaline.

The IIB22t horizon is light yellowish brown (10YR 6/4) or coarsely mottled in shades of yellow, brown, red, and gray. Texture is clay loam, clay, silty clay loam, or silty clay with about 35 to 50 percent content of clay. Reaction ranges from medium acid to moderately alkaline. The IIB3 horizon is similar to the IIB22t horizon in color and texture. As much as 20 percent shale or sandstone fragments, 2 millimeters to 75 millimeters in diameter, are in some pedons. Reaction ranges from medium acid to moderately alkaline.

The Prue soils are taxadjuncts to the Prue series because they are slightly more alkaline in reaction in the A and B2t horizons and are dry for slightly longer periods of time than described in the range for the series. Otherwise, they are similar in morphology, use, behavior, and management.

Roebuck series

The Roebuck series consists of deep, somewhat poorly drained, nearly level to slightly concave, very slowly permeable soils that formed in clayey alluvial sediment. They are on flood plains. Slopes are less than 1 percent.

Roebuck soils are geographically closely associated with the Gracemont, Harjo, and Yahola soils. Gracemont soils are closer to the channel and more sandy. Harjo soils are in a similar position on the landscape but are

less well drained, and they do not have a mollic epipedon. Yahola soils are on the natural levee along the stream channel and have a coarse-loamy control section.

Typical pedon of Roebuck clay, in a pasture 1 1/2 miles north of Sasakwa, 1,400 feet south and 100 feet west of the northeast corner of sec. 25, T. 6 N., R. 7 E.:

Ap—0 to 7 inches; reddish brown (5YR 5/3) clay, dark reddish brown (5YR 3/3) moist; weak fine granular structure; extremely hard, extremely firm; mildly alkaline; abrupt smooth boundary.

A1—7 to 24 inches; dark reddish gray (5YR 4/2) clay, dark reddish brown (5YR 3/2) clay; weak medium subangular blocky structure; extremely hard, extremely firm; cracks 1/8 to 1/4 inch wide filled with reddish brown clay; neutral; clear smooth boundary.

B2—24 to 44 inches; dark reddish gray (5YR 4/2) clay, dark reddish brown (5YR 3/2) moist; few fine prominent reddish yellow mottles; weak medium subangular blocky structure; extremely hard, extremely firm; few slickensides; neutral; clear smooth boundary.

C—44 to 60 inches; dark reddish gray (5YR 4/2) clay, dark reddish brown (5YR 3/2) moist; massive; extremely hard, extremely firm; few fine gypsum crystals; moderately alkaline.

Mottles in shades of brown, red, or yellow are in most pedons. A few pedons have a buried A horizon below a depth of 24 inches.

The A horizon is reddish brown (5YR 5/3, 4/4) in the upper part and reddish gray (5YR 5/2), dark brown (7.5YR 4/3), or dark reddish gray (5YR 4/2) in the lower part. Reaction is neutral or mildly alkaline.

The B2 horizon is dark grayish brown (5YR 4/2), reddish gray (5YR 5/2), or reddish brown (5YR 4/3, 4/4). Texture is clay, clay loam, or silty clay loam. Reaction ranges from slightly acid to moderately alkaline.

The C horizon has color and texture similar to that of the B horizon. Reaction is moderately alkaline.

Seminole series

The Seminole series consists of deep, moderately well drained, very gently sloping to gently sloping, slowly permeable soils that formed in material weathered from shale. These soils have a perched water table at a depth of 1 foot to 2 feet during winter and spring. They are on broad uplands. Slopes are generally 1 to 5 percent.

Seminole soils are geographically closely associated with the Aydelotte, Chickasha, Grainola, Lucien, and Waurika soils. Aydelotte soils are on higher areas and have a clayey B horizon. Chickasha soils are mainly on ridges and have a fine-loamy control section. Grainola and Lucien soils are on steeper areas and are shallower to bedrock. Waurika soils are nearly level, have lower chroma in the B horizon, and have an abrupt textural change from the A horizon to the B horizon.

Typical pedon of Seminole loam, from an area of Seminole loam, 1 to 3 percent slopes, in a native meadow 1 1/2 miles south and 3 miles west of the junction of Interstate 40 and Oklahoma Highway 99 north of Seminole, 250 feet north and 1,030 feet west of the southeast corner of sec. 1, T. 10 N., R. 5 E.:

A1—0 to 12 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; hard, friable; slightly acid; gradual wavy boundary.

B1—12 to 16 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; common fine distinct yellowish brown and strong brown mottles; moderate medium and fine subangular blocky structure; very hard, friable; few fine black bodies; slightly acid; gradual smooth boundary.

B21t—16 to 28 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; common fine distinct yellowish brown, strong brown, and grayish brown mottles; moderate medium subangular blocky structure; very hard, firm; few fine black bodies; nearly continuous clay films on faces of peds; few grayish brown silt coats on faces of peds and root channels; neutral; clear smooth boundary.

B22t—28 to 40 inches; light brownish yellow (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; common medium distinct brownish yellow (10YR 6/6), and reddish yellow (5YR 6/6) mottles; moderate medium subangular blocky structure; extremely hard, very firm; brown patchy clay films on faces of peds; grayish brown silt coats on faces of peds; few fine black bodies; few slickensides; 5 percent sandstone fragments up to 6 inches in diameter are in a 6-inch zone; moderately alkaline; diffuse smooth boundary.

B3—40 to 72 inches; light brown (7.5YR 6 4) clay, brown (10YR 4/4) moist; few medium distinct brownish yellow (10YR 6/6) mottles; weak coarse subangular blocky structure; extremely hard, very firm; patchy clay films on faces of peds; few fine calcium carbonate concretions; moderately alkaline.

Solum thickness is more than 60 inches. The A, B1, and B21t horizons range from medium acid to neutral. Below these horizons, reaction is moderately alkaline. The A1 or Ap horizon is grayish brown (10YR 5/2), brown (10YR 5/3, 4/3; 7.5YR 4/2, 5/2), or dark grayish brown (10YR 4/2).

The B1 horizon is grayish brown (10YR 5/2) or brown (10YR 4/3, 5/3; 7.5YR 5/2). Texture is loam or clay loam. The B2t horizon is brown (10YR 5/3), yellowish brown (10YR 5/4, 5/6), light yellowish brown (10YR 6/4), brownish yellow (10YR 6/6), light olive brown (2.5YR 5/4), or coarsely mottled. Mottles are in shades of yellow, red, or brown. Texture is clay or clay loam. The B3 horizon is light brown (7.5YR 6/4), light yellowish brown (10YR 6/4), brown (10YR 5/3; 7.5YR 5/4), or yellowish brown (10YR 5/4). Texture is clay or clay loam.

Soils with a slightly thinner epipedon were considered Seminole soils in naming the map units. Their behavior is similar enough to the Seminole series that little would be gained by adding other series names.

Shidler series

The Shidler series consists of shallow and very shallow, well drained, very gently sloping to gently sloping, moderately permeable soils that formed in material weathered from limestone. These soils are on uplands. Slopes are mainly 1 to 5 percent.

Shidler soils are geographically closely associated with the Catoosa and Newtonia soils that formed in material weathered from limestone. They are deeper and have an argillic horizon.

Typical pedon of Shidler silt loam, from an area of Shidler-Rock outcrop complex, 1 to 5 percent slopes, in a pasture 3 miles west and 4 miles south of Wewoka, 650 feet south and 50 feet east of the northeast corner of sec. 11, T. 7 N., R. 7 E.:

A11—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable; neutral; clear smooth boundary.

A12—7 to 14 inches; brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; weak medium and fine subangular blocky structure; hard, friable; neutral; clear smooth boundary.

A13—14 to 18 inches; brown (7.5YR 4/2) silt loam, dark brown 7.5YR 3/2) moist; weak medium and fine subangular blocky structure; hard, friable; neutral; clear smooth boundary.

R—18 to 20 inches; light gray (10YR 6/1) hard fractured limestone; fractures are 1 foot to 6 feet apart.

Solum thickness and depth to limestone range from 4 to 20 inches.

The A horizon is dark grayish brown (10YR 4/2), brown (7.5YR 4/2), reddish brown (5YR 4/3), or very dark grayish brown (10YR 3/2). Reaction is neutral or mildly alkaline, but some pedons are moderately alkaline and calcareous just above the bedrock or in the vicinity of quarries. The R layer is grayish or brownish hard limestone that is fractured vertically at intervals of 1 foot to 6 feet. Fractures range from 1 inch to 6 inches in width and 20 to 25 inches in depth. Horizontal bedding planes range from 4 to 24 inches apart.

Stephenville series

The Stephenville series consists of moderately deep, well drained, very gently sloping to strongly sloping, moderately permeable soils that formed in material weathered from sandstone. These soils are on uplands. Slopes are mainly 1 to 5 percent but range to about 12 percent.

Stephenville soils are geographically closely associated with the Darnell, Niotaze, and Wewoka soils. Darnell soils are on the crests of slopes and steeper areas, range from 10 to 20 inches deep, and do not have an argillic horizon. Niotaze soils are on lower, steeper slopes over shale, are moderately deep, and have a fine control section. Wewoka soils are on ridge crests and are less clayey.

Typical pedon of Stephenville fine sandy loam, from an area of Stephenville-Darnell complex, 3 to 12 percent slopes, in a pasture, about 2 miles east and 2 miles north of the junction of Oklahoma Highways 9 and 99 north of Seminole, 2,025 feet south and 275 feet west of the northeast corner of sec. 11, T. 9 N., R. 6 E.:

A1—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

A2—5 to 12 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

B21t—12 to 20 inches; strong brown (7.5YR 5/6) sandy clay loam, strong brown (7.5YR 4/6) moist; moderate medium subangular blocky structure; hard, friable; patchy clay films on faces of peds; medium acid; diffused smooth boundary.

B22t—20 to 26 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; common medium faint yellowish red (5YR 5/6) and common medium distinct light reddish brown (5YR 6/3) mottles; weak coarse subangular blocky structure; hard, friable; patchy clay films on ped faces; medium acid; clear smooth boundary.

Cr—26 to 30 inches, yellowish brown (10YR 5/6) sandstone; rippable.

Solum thickness and depth to bedrock range from 20 to 40 inches. Reaction of the A1, Ap, and A2 horizons ranges from strongly acid to slightly acid, but it may be neutral where the soils are limed.

The A1 or Ap horizon is brown (7.5YR 5/2; 10YR 5/3), grayish brown (10YR 5/2), pale brown (10YR 6/3), very pale brown (10YR 7/4), light yellowish brown (10YR 6/4), or yellowish brown (10YR 5/4). The A2 horizon is light brown (7.5YR 6/4), pale brown (10YR 6/3), light yellowish brown (10YR 6/4), or very pale brown (10YR 7/4).

The B2t horizon is reddish brown (2.5YR 5/4; 5YR 5/4), red (2.5YR 4/6, 5/6, 4/8, 5/8), strong brown (7.5YR 5/6), yellowish red (5YR 4/6, 5/6, 4/8, 5/8), or reddish yellow (5YR 6/6). Texture is sandy clay loam and is rarely fine sandy loam. Reaction is strongly acid or medium acid. Some pedons have a B3 horizon. The B3 horizon is similiar to the B2t horizon in color, texture, and reaction; but it has weaker structure. The Cr horizon is

reddish brown to yellowish brown sandstone that is rippable.

The Stephenville soils in this county are taxadjuncts to the Stephenville series because the upper part of the B2t horizon has hue of 7.5YR and mottles are in the lower part of the B2t horizon above the sandstone and are not described in the range for the series. Otherwise, they are similar in morphology, use, behavior, and management.

Teller series

The Teller series consists of deep, well drained, very gently sloping to gently sloping, moderately permeable soils that formed in loamy sediment. These soils are on broad uplands. Slopes are mainly 1 to 5 percent.

Teller soils are geographically closely associated with the Dougherty, Eufaula, and Konawa soils. Dougherty soils have a thick ochric epipedon and are in concave areas. Eufaula soils have a sandy control section and a thick ochric epipedon, and they are on ridges. Konawa soils are in similar areas and have an ochric epipedon.

Typical pedon of Teller loam, from an area of Teller loam, 1 to 3 percent slopes, in a pasture about 2 miles west and 1 mile south of Sasakwa, 1,500 feet south and 100 feet east of the northwest corner of sec. 3, T. 5 N., R. 7 E.:

A1—0 to 16 inches; reddish brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; weak fine granular structure; hard, very friable; slightly acid; clear smooth boundary.

B1—16 to 22 inches; reddish brown (5YR 5/4) loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; hard, friable; patchy clay films on faces of peds; slightly acid; clear smooth boundary.

B21t—22 to 30 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; very hard, friable; nearly continuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B22t—30 to 48 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak to moderate medium subangular blocky structure; very hard, friable; patchy clay films on faces of peds; slightly acid; gradual smooth boundary.

B3—48 to 60 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak coarse subangular blocky structure; very hard, friable; patchy clay films on faces of peds; slightly acid.

Solum thickness ranges from 60 to more than 72 inches. The A1 or Ap horizon is dark grayish brown (10YR 4/2), brown (10YR 5/3; 7.5YR 4/2), grayish brown (10YR 5/2), or reddish brown (5YR 5/3, 4/3). Reaction is medium acid or slightly acid.

The B1 horizon is brown (7.5YR 4/2, 5/2, 5/4) or reddish brown (5YR 4/2, 4/4, 5/2, 5/4). Texture is loam or fine sandy loam, and reaction is medium acid or slightly acid.

The B2t horizon is reddish brown (5YR 4/4, 5/4), yellowish red (5YR 5/6), or reddish yellow (5YR 6/6). Texture is sandy clay loam or clay loam, and reaction is medium acid or slightly acid.

The B3 horizon is reddish brown (5YR 5/4), reddish yellow (5YR 6/6), or yellowish red (5YR 5/6). Reaction ranges from medium acid to neutral.

The C horizon, where present, is yellowish brown or yellowish red fine sandy loam.

Tullahassee series

The Tullahassee series consists of deep, somewhat poorly drained, moderately rapidly permeable soils that formed in predominantly loamy alluvial sediment. These soils are mainly on narrow flood plains of the minor streams. They have an apparent water table at a depth of 2 to 3 feet during winter and spring. Slopes are less than 1 percent and slightly concave.

Tullahassee soils are geographically closely associated with the Gowton, Madill, and Wynona soils. Gowton soils are well drained, have a mollic epipedon, and have a fine-loamy control section. Madill soils are better drained and less frequently flooded. Wynona soils have a fine-silty control section.

Typical pedon of Tullahassee fine sandy loam, in a pasture 1 mile north of Lima, 2,300 feet west and 800 feet south of the northeast corner of sec. 7, T. 8 N., R. 7 E.:

A1—0 to 8 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; slightly acid; gradual smooth boundary.

C1—8 to 30 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable; bedding planes are evident; neutral; clear smooth boundary.

Ab—30 to 48 inches; gray (10YR 5/1) loam; dark gray (10YR 4/1) moist; common medium distinct dark yellowish brown (10YR 4/4), dark grayish brown (10YR 4/2), and gray (N 5/0) mottles; massive; hard, friable; neutral; gradual smooth boundary.

Bb—48 to 60 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; common coarse distinct dark grayish brown (10YR 4/2), dark gray (10YR 4/1), and gray (N 5/0) mottles; massive; hard, friable; neutral.

Reaction of this soil is slightly acid in the A1 and C1 horizons and ranges from neutral to moderately alkaline in the Ab and Bb horizons. The A1 horizon is grayish brown (10YR 5/2) or brown (10YR 5/3, 4/3). The C1 horizon is pale brown (10YR 6/3) or brown (10YR 5/3)

with bedding planes. Strata of finer and coarser sediments than fine sandy loam are common.

The Ab or Bb horizon is dark grayish brown (10YR 4/2), brown (10YR 5/3), dark gray (10YR 4/1), or gray (10YR 5/1) with common to many, medium to large, grayish and brownish mottles. Texture is loam, silt loam, or fine sandy loam.

The Tullahassee soils are taxadjuncts to the Tullahassee series because they are slightly more alkaline in reaction and have mottles at a greater depth than described in the range for the Tullahassee series. Otherwise, they are similar in morphology, use, behavior, and management.

Waurika series

The Waurika series consists of deep, somewhat poorly drained, nearly level, very slowly permeable soils that formed in material weathered from shale. These soils are on uplands. They have a perched water table at a depth of 1 to 2 feet during winter and spring. Slopes are less than 1 percent and slightly concave to plane.

Waurika soils are geographically closely associated with the Aydelotte, Chickasha, Grainola, Lucien, and Seminole soils. Aydelotte soils have a thinner epipedon, do not have an albic horizon or aquic properties, and are on convex areas. Chickasha soils are formed in material weathered from sandstone, generally are on the tops of ridges, have a fine-loamy control section, and have sandstone bedrock at a depth of 40 to 60 inches. Grainola and Lucien soils are on steep areas and are less shallow to bedrock. Seminole soils are steeper, are better drained, have a thicker A horizon, and have a more gradual transition from the A horizon to the B2t horizon.

Typical pedon of Waurika silt loam, from an area of Waurika silt loam, 0 to 1 percent slopes, in a meadow about 2 miles west of the junction of Oklahoma Highway 99 and 99A north of Seminole, 2,000 feet north and 300 feet west of the southeast corner of sec. 7, T. 10 N., R. 3 E.:

A1—0 to 9 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; moderate medium granular structure; slightly hard, friable; slightly acid; clear smooth boundary.

A2—9 to 11 inches; light gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

B21t—11 to 30 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium and fine blocky structure becoming nearly massive in the lower 6 inches; very hard, firm; nearly continuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B22t—30 to 44 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse blocky structure; very hard, very firm; nearly continuous clay films on faces of peds; moderately alkaline; gradual smooth boundary.

B3ca—44 to 60 inches; coarsely mottled yellowish brown (10YR 5/6) and light gray (10YR 6/1) clay loam; weak coarse subangular blocky structure; very hard, very firm; patchy clay films on faces of peds; few fine calcium carbonate concretions; few films of soft secondary lime; moderately alkaline.

The solum is more than 54 inches thick. The A horizon **ranges from 8 to 11 inches in thickness. The A1 horizon** is grayish brown (10YR 5/2) or gray (10YR 5/1). The A2 horizon is about one unit higher in value than the A1 horizon. Reaction of the A horizon is medium acid or slightly acid.

The B2t horizon is dark grayish brown (10YR 4/2), dark gray (10YR 4/1), or grayish brown (2.5Y 5/2; 10YR 5/2). Reaction is slightly acid or neutral in the upper part to moderately alkaline in the lower part. The B3 horizon is light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), or coarsely mottled gray, grayish brown, brownish yellow, or yellowish brown. Texture is clay or clay loam.

The Waurika soils are slightly more acid in reaction than described in the range for the Waurika series. Otherwise, they are similar in morphology, use, behavior, and management.

Wewoka series

The Wewoka series consists of moderately deep, somewhat excessively drained, moderately rapidly permeable soils that formed in material weathered from chert conglomerate on uplands. These soils are gently sloping to strongly sloping. Slopes are mainly 3 to 8 percent but range to as much as 12 percent.

Wewoka soils are geographically closely associated with the Darnell, Niotaze, and Stephenville soils. Darnell soils formed in material weathered from sandstone, are less than 20 inches to bedrock, and are in similar areas. Niotaze soils are on side slopes, formed in material weathered from shale, and have a fine control section. Stephenville soils formed in material weathered from sandstone on ridges and flatter slopes, have a fine-loamy control section, and are moderately deep over sandstone.

Typical pedon of Wewoka gravelly sandy loam, from an area of Niotaze-Wewoka complex, 3 to 12 percent slopes, in a forested area about 6 miles south and 7 miles west of Wewoka, about 1,200 feet east and 600 feet north of the southwest corner of sec. 18, T. 7 N., R. 7 E.:

A1—0 to 5 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; moderate medium granular structure; slightly hard, very friable; 25 percent by volume of rounded chert fragments 2 to 76 millimeters in diameter and a few rounded chert fragments 76 to 250 millimeters in diameter; medium acid; clear smooth boundary.

A2—5 to 17 inches; pink (7.5YR 7/4) gravelly loamy sand, light brown (7.5YR 6/4) moist; weak fine granular structure; slightly hard, very friable; 40 percent by volume of rounded chert fragments 2 to 76 millimeters in diameter and a few rounded chert fragments 76 to 250 millimeters in diameter; strongly acid; clear wavy boundary.

B2—17 to 22 inches; reddish yellow (5YR 7/6) very gravelly loamy sand, reddish yellow (5YR 6/6) moist; weak fine granular structure; slightly hard, very friable; 60 percent by volume of rounded chert fragments 2 to 76 millimeters in diameter and a few rounded chert fragments 76 to 250 millimeters in diameter; strongly acid; clear irregular boundary.

Cr—22 to 40 inches; reddish yellow (5YR 6/8) cherty conglomerate, yellowish red (5YR 5/8) moist; conglomerate can be crushed with moderate to strong hand pressure; fractures in the conglomerate are 1/2 inch to 1 inch wide and 6 to 12 inches apart; strongly acid.

Solum thickness and depth to bedrock ranges from 20 to 40 inches. Reaction of all horizons ranges from very strongly acid to neutral.

The A1 horizon is brown (10YR 5/3), grayish brown (10YR 5/2), or dark grayish brown (10YR 4/2). Rounded chert fragments, 2 to 76 millimeters in diameter, range from 10 to 45 percent by volume, and fragments from 76 to 250 millimeters in diameter range from 0 to 5 percent by volume.

The A2 horizon is pink (7.5YR 7/4), light brown (7.5YR 6/4, 6/3), brown (7.5YR 5/3), or reddish yellow (7.5YR 7/6). Texture is gravelly loamy sand or very gravelly loamy sand. Rounded chert fragments, 2 to 76 millimeters in diameter, range from 20 to 75 percent by volume, and fragments from 76 to 250 millimeters in diameter range from 0 to 5 percent by volume.

The B2 horizon is reddish yellow (5YR 7/6), reddish brown (5YR 5/4), pink (7.5YR 7/4), or light brown (7.5YR 6/4). Rounded chert fragments, 2 to 76 millimeters in diameter, range from 50 to 80 percent by volume, and fragments from 76 to 250 millimeters in diameter range from 0 to 5 percent.

The Cr horizon is chert conglomerate. In some pedons the material can be crushed by moderate hand pressure, and in some pedons the material can barely be chipped by a spade. The fine particles in the slightly weathered conglomerate are reddish yellow (5YR 6/8), yellowish red (5YR 5/6), or reddish brown (5YR 5/4).

Wynona series

The Wynona series consists of deep, somewhat poorly drained, nearly level, slowly permeable soils that formed in alluvial sediment. These soils are on flood plains. They have a perched water table within 2 feet of the soil surface during winter and spring. Slopes are less than 1 percent.

Wynona soils are geographically closely associated with the Gowton, Madill, and Tullahassee soils. Gowton soils are better drained and have a fine-loamy control section. Madill and Tullahassee soils are in similar positions and have a coarse-loamy control section. Madill soils are better drained.

Typical pedon of Wynona silt loam, in a pasture at the north edge of Wewoka, 1,250 feet north and 400 feet east of the southwest corner of sec. 18, T. 8 N., R. 8 E.:

A11—0 to 6 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; very weak fine granular structure; hard, friable; few fine strata of gray silty clay loam and clay loam; neutral; abrupt smooth boundary.

A12—6 to 20 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate medium granular structure; hard, firm; neutral; clear smooth boundary.

A13—20 to 32 inches; grayish brown (10YR 5/2) silty clay loam; very dark brown (10YR 2/2) moist; common medium faint gray (10YR 5/1) and dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; hard, firm; neutral; gradual smooth boundary.

B21g—32 to 48 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; common medium faint gray (10YR 5/1) and dark brown (10YR 4/3) mottles; weak medium subangular blocky structure; hard, firm; slightly acid; gradual smooth boundary.

B22g—48 to 60 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; common coarse faint gray (10YR 5/1) and yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; hard, firm; few seams and threads of salt crystals; moderately alkaline.

The solum ranges from 56 to more than 60 inches in thickness. Thickness of the mollic epipedon ranges from 26 to more than 40 inches. Reaction of the A horizon is neutral or mildly alkaline and is slightly acid to neutral in the B2g horizon.

In many pedons the A11 horizon is light gray (10YR 6/1) or light brownish gray (10YR 6/2) of recent sediment, but it is gray (10YR 5/1) or grayish brown (10YR 5/2) in most pedons. The A12 horizon is dark grayish brown (10YR 4/2) or gray (10YR 5/1). Texture is silty clay loam or clay loam. The A13 horizon is grayish brown (10YR 5/

2), dark gray (10YR 4/1), or dark grayish brown (10YR 4/2) and has grayish and brownish mottles.

The B2g horizon is gray (10YR 5/1), dark gray (10YR 4/1), or grayish brown (10YR 5/2) and has grayish and brownish mottles. In some pedons it is coarsely mottled in shades of red, brown, or gray.

The Wynona soils are slightly more alkaline in reaction than described in the range for the Wynona series. Otherwise, they are similar in morphology, use, behavior, and management.

Yahola series

The Yahola series consists of deep, well drained, smooth and slightly undulating, moderately rapidly permeable soils that formed in alluvial sediment on flood plains. Slopes are less than 1 percent.

Yahola soils are geographically closely associated with the Asher, Gaddy, Gracemont, Gracemore, Harjo, Keokuk, and Roebuck soils. Asher and Keokuk soils are on higher flood plains. Asher soils have a fine-silty control section, and Keokuk soils have a coarse-silty control section. Gaddy soils are in a slightly higher position on the landscape and are closer to the stream channel. They have a sandy control section. Gracemont and Gracemore soils are in slightly lower positions on the landscape near the stream channel and have an apparent water table at a depth of 1/2 foot to 3 feet during winter and spring. Harjo and Roebuck soils are further from the stream channel and are more clayey.

Typical pedon of Yahola fine sandy loam, in a pasture about 7 miles west and 1 1/2 miles north of the junction of Oklahoma Highway 99 and Interstate 40 north of Seminole, 300 feet south and 50 feet east of the northwest corner of sec. 27, T. 11 N., R. 5 E.:

A1—0 to 7 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

C1—7 to 44 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, very friable; thin strata of finer or coarser textures; bedding planes evident; calcareous; moderately alkaline; clear smooth boundary.

Ab—44 to 60 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable; calcareous; moderately alkaline.

Buried soils may not be present. Where present they may be below a depth of 30 inches. The A1 or Ap horizon is brown (10YR 5/3; 7.5YR 5/4), pale brown (10YR 6/3), or reddish brown (5YR 5/4). Reaction is mildly alkaline or moderately alkaline. This horizon may or may not be calcareous in the upper 10 inches but is calcareous below a depth of 10 inches.

The C horizon is light yellowish brown (10YR 6/4), very pale brown (10YR 7/4), reddish brown (5YR 5/4), or reddish yellow (5YR 6/6). Texture is fine sandy loam stratified with finer or coarser textures to a depth of 40 inches and fine sandy loam or loamy fine sand stratified with finer or coarser textures below. Where present, the Ab horizon is dark grayish brown (10YR 4/2) or very dark brown (10YR 2/2). Texture is loam or silty clay loam.

The Yahola soils have hue of 10YR and are slightly outside the Yahola series. Otherwise, they are similar in morphology, use, behavior, and management.

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*5*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 19, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning dry, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Argiustolls (*Argi*, meaning argillic horizons, plus *ustolls*, the suborder of Mollisols that has an ustic moisture regime).

SUBGROUP. Each great group may be divided into three kinds of subgroup: the central (typic) concept of the great group, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great group; and the extragrades, which have some properties that are representa-

tive of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Argiustolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, thermic Typic Argiustolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the soils

This section discusses the factors of soil formation, relates them to soils in the survey area, and explains the processes of soil formation.

Factors of soil formation

The properties of the soil at any given place result from the integrated effects of five major factors of soil formation—parent material, climate, plant and animal life, relief, and time. Few generalizations can be made regarding the effect of any one factor, because the effect of each one is modified by the other four.

Parent material

Parent material is one of the most influential factors of soil formation in the county. It sets the limits of the chemical and mineralogical composition of the soil and influences the rate of soil development. Parent material is the unconsolidated material from which soil is formed. Seminole County has several kinds of parent material, all producing different soils.

Soils formed in material weathered from shale, such as the Aydelotte and Grainola soils, have a clayey subsoil. Those formed in material weathered from sandstone, such as the Chickasha or Bates soils, have a loamy subsoil. Soils formed in material weathered from limestone are the Shidler or Newtonia soils. Examples of soils formed in clayey, loamy, or sandy sediment on uplands are the Okemah, Teller, and Eufaula soils. Examples of soils formed in clayey, loamy, or sandy sediment on flood plains are the Roebuck, Gowton, and Gaddy soils.

Climate

The moist, subhumid continental climate of Seminole County is characterized by rains of high intensity. Moisture and warm temperatures have been sufficient to promote the formation of distinct horizons in many of the soils. Differences in soils, however, cannot be attributed to the climate because the climate is uniform throughout the county. Heavy rains have caused rapid runoff that has eroded many soils. This erosion is an indirect effect of climate.

Plants and animals

Plants, burrowing animals, insects, and soil micro-organisms have a direct influence on the formation of soils. Native vegetation, such as trees, grasses, or a combination of both, has a bearing on the amount of organic matter, amounts and kinds of plant nutrients, and the type of soil structure and consistence. The Teller soils are formed under native grasses. The fibrous roots of these native grasses promote a good granular structure that is high is organic-matter content. This type of vegetation reduces loss of soil nutrients by the recycling and the feeding ability of the deep grass roots. Consequently, soils that formed under grass in Seminole County tend to have more bases and organic matter than the soils that formed under trees. The Konawa soils developed under trees and are, therefore, lower in plant nutrients and organic matter than those that developed under grasses.

During the past century man has altered this soil-forming process by removing the native vegetation over much of the county. Absence of adequate conservation measures has resulted in much soil loss through sheet and gully erosion. Where most of the surface layer has been removed or many gullies have formed, eroded phases of soils are mapped. An example is Konawa loamy fine sand, gullied.

Relief

Relief affects soil formation through its influence on moisture, drainage, erosion, temperature, and plant cover. The relief of Seminole County is determined largely by the resistance of underlying parent material to weathering and geological erosion. In about 14 percent of Seminole County, the soils are on nearly level or very gently sloping flood plains, and in about 86 percent they are on uplands.

The effects of relief on soil formation is illustrated by Stephenville and Darnell soils, both of which formed in material weathered from sandstone. The Stephenville soils generally are in areas of less sloping relief. Surface runoff is less, and more water percolates through these

soils to influence the loss, gain, or transfer of soil constituents. The Darnell soils are in areas of more sloping relief and have a less clearly defined profile than Stephenville soils. On the more sloping soils, more of the rainwater runs off instead of moving through the soil to help in the formation of a deeper solum.

Time

The soils of Seminole County range from young to old. Two of the old or mature soils are Waurika and Okemah soils on uplands. The Bates and Stephenville soils are younger, but they have clearly defined soil horizons. The Grainola and Darnell soils are considered young or immature soils. They have had sufficient time to develop clearly defined horizons, but because they are sloping, geological erosion has taken away soil material almost as fast as it formed. The Madill and Yahola soils on flood plains have been developing for such a short time that they show little horizon development.

Processes of soil formation

Processes that have influenced the formation of horizons in the soils of Seminole County are (1) accumulation of organic matter, (2) leaching of calcium carbonates and bases, and (3) translocation of silicate clay minerals. In most soils, more than one of these processes have been active in the development of horizons. Some processes have retarded horizon differentiation.

By adding organic matter to the surface layer, native grasses have contributed to the granular structure of that layer in soils on the prairie. In the classification system, granular surface layers that are high in organic matter content, such as the surface layer of the Teller soils, are called mollic epipedons. Stephenville soils formed under native trees in material weathered from sandstone. They contain less organic matter than the Teller soils, and their surface layer is called an ochric epipedon.

Leaching of calcium carbonates and bases is active in the development of soils. The accumulation of calcium carbonates and bases in the lower part of the B horizon of the Aydelotte soils indicates the depth to which water has percolated. The Chickasha, Teller, and Seminole soils have been leached to the extent that they have no accumulation of calcium carbonates. The Konawa, Dougherty, and Eufaula soils have a distinct A2 horizon that has been leached of bases. The B horizon of these soils has had much leaching of bases, as reflected by their low base saturation.

Soils on flood plains, such as the Gaddy and Yahola soils, are recharged with bases during each flood. The Madill soils have not been leached, but their sediment comes from leached, acid soils. The Grainola soils formed in shale that is high in carbonates. These soils are young and have had very little leaching.

The translocation of silicate clay minerals is very important in the properties and the classification of soils. Argillic horizons are diagnostic for classification. Clay films on faces of peds and bridging sand grains and increases in total clay are used in the field as evidence of an argillic horizon. An argillic horizon is in the Bates, Prue, and Stephenville soils. The varying degrees of translocation of silicate clay minerals and the kind of parent material present have resulted in wide variation in the texture and other properties of the argillic horizon of soils in Seminole County. The Stephenville, Konawa, Dougherty, and Eufaula soils have a surface layer that is more intensely leached of silicate clay minerals than the surface layer of other soils in the county.

The grasses on the soils of the prairie bring bases to the surface and thus retard complete leaching and formation of an A2 horizon. Geological erosion on the gently sloping to strongly sloping Shidler and Darnell soils hinders horizonation through soil losses. The sediment of the Yahola, Madill, and other soils on flood plains were deposited so recently that there has not been enough time for the formation of horizons.

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Glossary

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Low	0 to 4
Moderate	4 to 6
High	More than 6

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earth-moving equipment. The soil sloughs easily.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess alkali. Excess exchangeable sodium. The resulting poor physical properties restrict the growth of plants.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gypsum. Hydrous calcium sulphate.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. One method of irrigation is—

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10

square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characterisitc that affects management. These differencees are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Polypedon. A volume of soil having properties within the limits of a soil series, the lowest and most homogeneous category of soil taxonomy. A "soil individual."

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor*. The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; contains harmful salts and is strongly alkaline; or contains harmful salts and exchangeable sodium and is very strongly alkaline. The salts, exchangeable sodium, and alkaline reaction are in the soil in such location that growth of most crop plants is less than normal.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate

types. Some wind-deposited sand is consolidated into sandstone.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. Locally, a small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to $Ca^{++} + Mg^{++}$. The degrees of sodicity are—

	SAR
Slight	Less than 13:1
Moderate	13-30:1
Strong	More than 30:1

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitaion is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series be-

cause they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or " very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

ILLUSTRATIONS

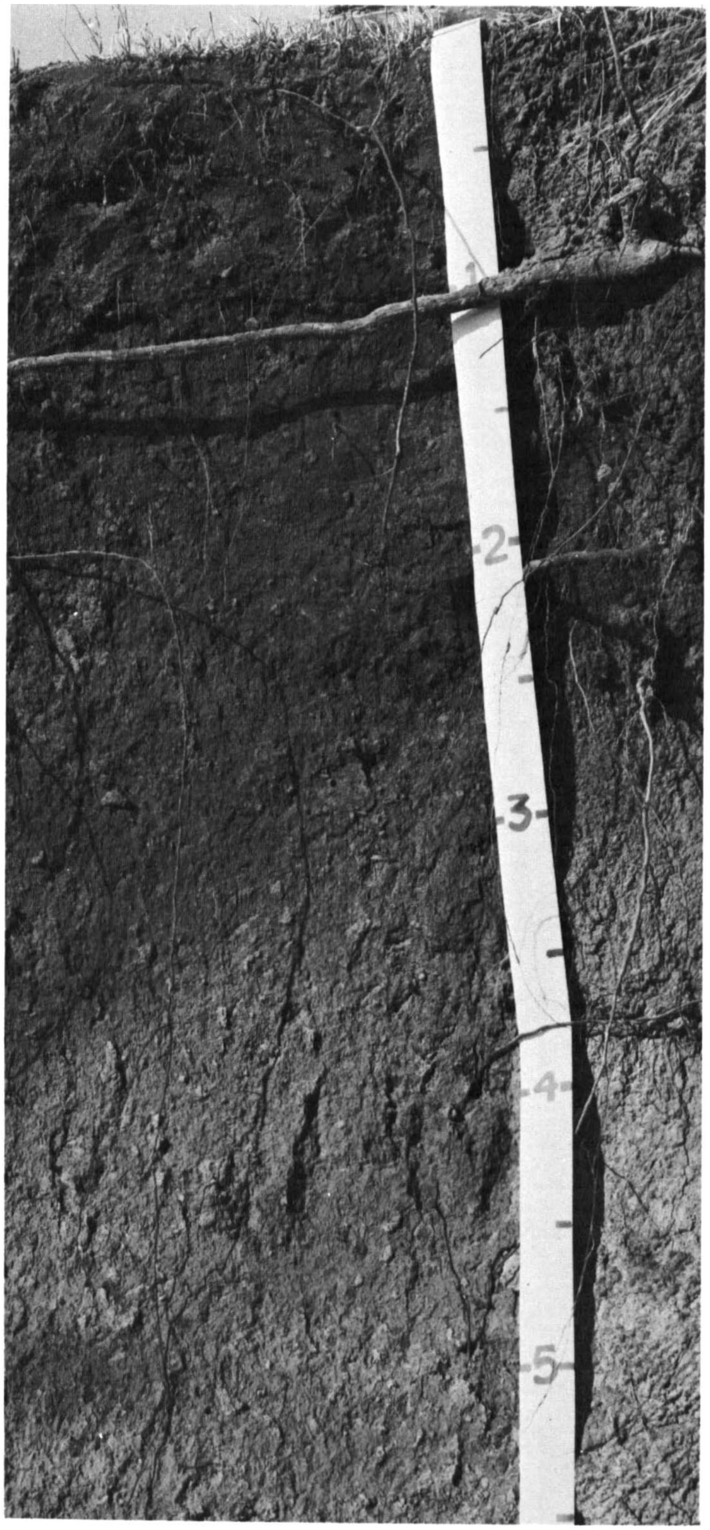

Figure 1.—Profile of Gowton loam showing deep root depth.

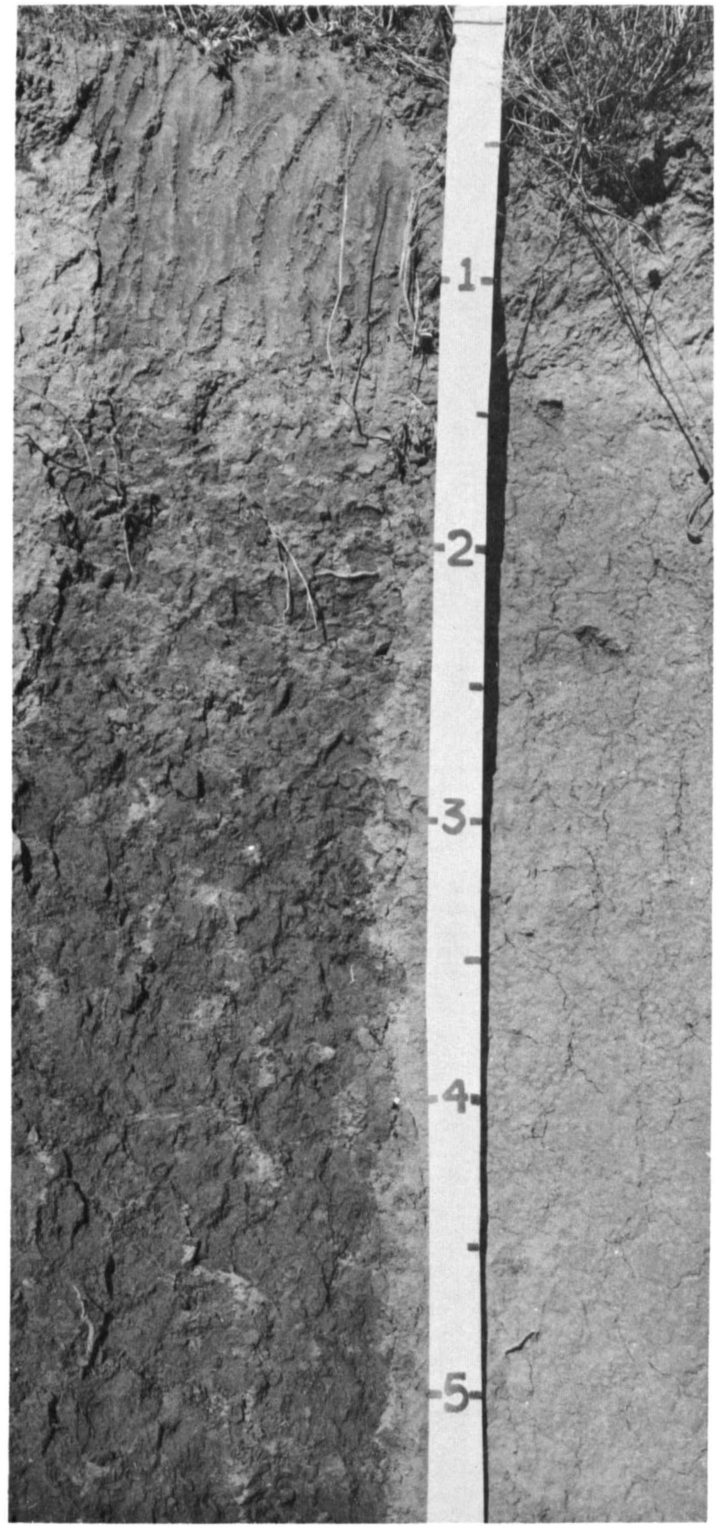

Figure 2.—Profile of Konawa fine sandy loam, 0 to 3 percent slopes, showing depth to subsoil at about 1 1/2 feet.

Figure 3.—An area of Niotaze-Darnell complex, 8 to 30 percent slopes, used for grazing.

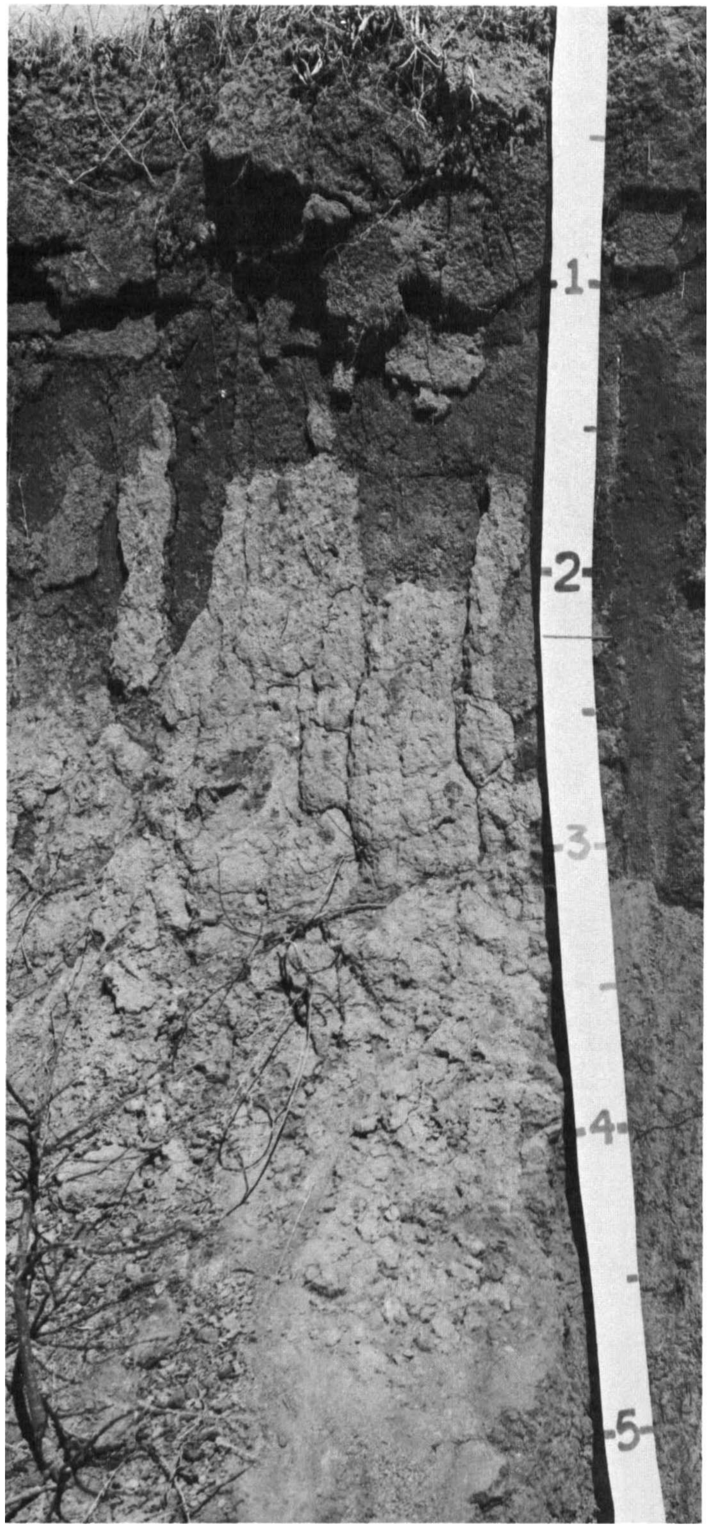

Figure 4.—Profile of Prue loam, 1 to 3 percent slopes, showing depth of roots.

Figure 5.—Area of Seminole, Chickasha, and Prue soils, 2 to 8 percent slopes, severely eroded.

Figure 6.—Area of Harjo clay showing the surface drainage problem.

Figure 7.—Vetch seeded in bermudagrass on Teller loam, 1 to 3 percent slopes.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Bermudagrass (Improved)				9	18	20	16	10	14	9	4	
Bermudagrass & Fescue	8	8	10	14	7	7	9	8	10	5	5	8
Fescue	12	12	15	20	18	5					3	15
Small Grain (Graze Out)	5	11	29	29	14						5	7
Forage Sorghum						14	29	29	21	7		

Figure 8.—Maximum percentage of yearly forage growth that can be safely grazed each month.

Figure 9.—An area of the Loamy Prairie range site in fair condition on the Eram part of the Eram-Coweta complex, 3 to 12 percent slopes.

Figure 10.—An area of the Sandy Savannah range site in poor condition on the Stephenville part of the Stephenville-Darnell complex, 3 to 12 percent slopes.

Figure 11.—An area of the Shallow Prairie range site in good condition on the Grainola part of Grainola-Lucien complex, 3 to 12 percent slopes.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[Recorded in the period 1951-74 at Wewoka, Oklahoma]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	50.8	26.6	38.7	75	-1	19	1.46	.51	2.21	3	2.4
February	56.5	30.7	43.7	80	8	40	1.48	.61	2.18	4	1.9
March	64.0	38.0	51.0	88	13	175	2.47	1.21	3.49	5	1.0
April	73.9	49.3	61.6	91	26	355	3.86	2.10	5.29	6	.0
May	80.6	57.3	69.0	93	37	589	5.38	2.67	7.58	7	.0
June	88.4	65.5	77.0	99	47	810	4.34	2.09	6.17	5	.0
July	93.7	69.2	81.5	105	54	977	3.13	.95	4.88	5	.0
August	93.7	67.4	80.6	106	52	949	3.16	.90	4.97	4	.0
September	86.2	60.5	73.4	100	40	702	4.63	1.74	6.94	5	.0
October	76.7	49.5	63.1	93	29	406	3.35	.90	5.31	4	.0
November	63.3	37.6	50.5	82	14	108	2.26	.46	3.70	3	.4
December	53.3	29.6	41.5	76	3	26	1.94	.82	2.87	3	1.5
Year	73.4	48.4	61.0	107	-3	5,156	37.46	29.24	45.21	54	7.2

[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-74 at Wewoka, Oklahoma]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 4	April 12	April 20
2 years in 10 later than--	March 29	April 8	April 16
5 years in 10 later than--	March 18	March 29	April 8
First freezing temperature in fall:			
1 year in 10 earlier than--	October 30	October 24	October 15
2 years in 10 earlier than--	November 5	October 29	October 19
5 years in 10 earlier than--	November 17	November 7	October 26

TABLE 3.--GROWING SEASON LENGTH

[Recorded in the period 1951-74 at Wewoka, Oklahoma]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	219	203	186
8 years in 10	227	209	191
5 years in 10	243	222	201
2 years in 10	259	235	210
1 year in 10	267	242	215

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Asher silty clay loam	920	0.2
2	Aydelotte loam, 2 to 5 percent slopes	765	0.2
3	Bates loam, 1 to 3 percent slopes	1,350	0.7
4	Bates loam, 3 to 5 percent slopes	1,750	0.4
5	Bates-Coweta complex, 2 to 5 percent slopes	1,410	0.3
6	Chickasha loam, 2 to 5 percent slopes	3,110	0.8
7	Dennis loam, 3 to 5 percent slopes	3,410	0.8
8	Dougherty loamy fine sand, 3 to 8 percent slopes (W)	1,210	0.3
9	Eram-Coweta complex, 3 to 12 percent slopes	2,870	0.7
10	Eufaula-Dougherty complex, 0 to 3 percent slopes (W)	1,410	0.3
11	Eufaula-Dougherty complex, 3 to 12 percent slopes (W)	7,215	1.8
12	Gaddy loamy fine sand	1,185	0.3
13	Gowton loam	14,855	3.7
14	Gowton soils	12,620	3.1
15	Gracemont fine sandy loam	4,910	1.2
16	Gracemore loamy fine sand	665	0.2
17	Grainola and Aydelotte soils, 3 to 8 percent slopes, severely eroded	6,055	1.5
18	Grainola-Lucien complex, 3 to 12 percent slopes	8,605	2.1
19	Harjo clay	2,460	0.6
20	Keokuk silt loam	1,575	0.4
21	Konawa fine sandy loam, 0 to 3 percent slopes	3,055	0.8
22	Konawa fine sandy loam, 3 to 5 percent slopes	6,020	1.5
23	Konawa fine sandy loam, 2 to 5 percent slopes, eroded	11,505	2.8
24	Konawa fine sandy loam, gullied	8,790	2.2
25	Madill fine sandy loam	6,180	1.5
26	Newtonia-Catoosa complex, 1 to 3 percent slopes	1,495	0.4
27	Niotaze-Darnell complex, 8 to 30 percent slopes	25,140	6.2
28	Niotaze-Wewoka complex, 3 to 12 percent slopes	37,195	9.2
29	Oil-waste land	660	0.2
30	Okemah silt loam, 0 to 1 percent slopes	510	0.1
31	Okemah silt loam, 1 to 3 percent slopes	3,535	0.9
32	Okemah-Carytown complex, 0 to 2 percent slopes	1,720	0.4
33	Pits	1,860	0.5
34	Prue loam, 1 to 3 percent slopes	905	0.2
35	Prue loam, 3 to 5 percent slopes	2,240	0.6
36	Roebuck clay	2,680	0.7
37	Seminole loam, 1 to 3 percent slopes	3,605	0.9
38	Seminole loam, 2 to 5 percent slopes, eroded	19,855	4.9
39	Seminole, Chickasha, and Prue soils, 2 to 8 percent slopes, severely eroded	24,700	6.1
40	Seminole-Gowton complex, 0 to 12 percent slopes	11,880	2.9
41	Shidler-Rock outcrop complex, 1 to 5 percent slopes	2,440	0.6
42	Stephenville fine sandy loam, 1 to 3 percent slopes	5,075	1.3
43	Stephenville fine sandy loam, 3 to 5 percent slopes	19,390	4.8
44	Stephenville-Darnell complex, 3 to 12 percent slopes	72,604	18.0
45	Stephenville-Darnell complex, 3 to 12 percent slopes, severely eroded	36,925	9.1
46	Teller loam, 1 to 3 percent slopes	2,400	0.6
47	Teller loam, 3 to 5 percent slopes	1,145	0.3
48	Tullahassee fine sandy loam	3,285	0.8
49	Waurika silt loam, 0 to 1 percent slopes	835	0.2
50	Wynona silt loam	1,750	0.4
51	Yahola fine sandy loam	5,535	1.4
	Water	1,216	0.3
	Total	404,480	100.0

TABLE 5.--GRAZING YIELDS PER ACRE

[Yields were estimated for a high level of management. Absence of a yield figure indicates that the crop or pasture grass is seldom grown or is not suited to that soil]

	Improved bermudagrass	Fescue-bermudagrass	Fescue	Small grains	Forage sorghum
	AUM*	AUM	AUM	AUM	AUM
1------------ Asher	7.5	---	---	4.5	3.5
2------------ Aydelotte	2.5	---	---	2.5	1.5
3------------ Bates	6.0	---	---	4.0	2.5
4------------ Bates	5.5	---	---	3.5	2.0
5**---------- Bates	5.0	---	---	2.5	1.5
6------------ Chickasha	5.5	---	---	3.5	2.5
7------------ Dennis	5.5	7.0	4.5	3.0	6.5
8------------ Dougherty	5.0	---	---	---	2.0
9**---------- Eram	---	---	---	---	---
10**--------- Eufaula	4.5	---	---	---	1.5
11**--------- Eufaula	4.0	---	---	---	---
12----------- Gaddy	6.0	---	---	3.5	2.5
13----------- Gowton	7.5	8.5	6.0	5.0	3.5
14----------- Gowton	7.5	8.5	6.0	---	---
15----------- Gracemont	8.5	9.5	7.0	---	---
16----------- Gracemore	7.0	7.5	5.0	---	---
17**--------- Grainola	2.0	---	---	---	---
18**--------- Grainola	---	---	----	---	---
19----------- Harjo	5.5	6.0	5.0	---	---
20----------- Keokuk	8.0	---	---	5.0	3.5

See footnotes at the end of table.

TABLE 5.--GRAZING YIELDS PER ACRE--Continued

	Improved bermudagrass	Fescue-bermudagrass	Fescue	Small grains	Forage sorghum
	AUM	AUM	AUM	AUM	AUM
21-------------- Konawa	7.0	---	---	3.5	3.0
22-------------- Konawa	6.0	---	---	3.0	2.5
23-------------- Konawa	6.5	---	---	3.0	2.5
24-------------- Konawa	4.5	---	---	---	---
25-------------- Madill	7.5	---	---	4.0	3.0
26**------------ Newtonia	5.5	---	---	4.0	3.0
27**------------ Niotaze	---	---	---	---	---
28**------------ Niotaze	---	---	---	---	---
29**------------ Oil waste-land	---	---	---	---	---
30-------------- Okemah	6.5	8.0	5.5	4.0	7.5
31-------------- Okemah	6.0	7.5	5.0	3.5	7.0
32**------------ Okemah	3.5	---	---	2.5	2.0
33-------------- Pits	---	---	---	---	---
34-------------- Prue	6.0	7.5	5.0	3.5	7.0
35-------------- Prue	5.5	7.0	4.5	3.0	6.5
36-------------- Roebuck	6.0	7.5	5.5	---	---
37-------------- Seminole	5.5	---	---	4.0	3.0
38-------------- Seminole	5.0	---	---	3.5	2.5
39**------------ Seminole	4.5	---	---	---	---
40**------------ Seminole	5.0	---	---	---	---
41-------------- Shidler	---	---	---	---	---

See footnotes at end of table.

TABLE 5.--GRAZING YIELDS PER ACRE--Continued

	Improved bermudagrass	Fescue-bermudagrass	Fescue	Small grains	Forage sorghum
	AUM	AUM	AUM	AUM	AUM
42------------- Stephenville	6.0	---	---	3.5	2.5
43------------- Stephenville	5.5	---	---	3.0	2.0
44**----------- Stephenville	4.5	---	---	---	---
45**----------- Stephenville	4.0	---	---	---	---
46------------- Teller	7.5	---	---	4.0	3.0
47------------- Teller	6.5	---	---	3.5	2.5
48------------- Tullahassee	8.0	9.5	7.0	---	---
49------------- Waurika	5.0	7.0	4.0	3.0	2.5
50------------- Wynona	8.5	10.0	6.5	4.5	4.0
51------------- Yahola	7.5	---	---	4.0	3.0

*AUM is Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

**This map unit is made up of two or more dominant kinds of soil. See description of the map unit for behavior characteristics and composition of the map unit.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Wheat	Grain sorghum	Alfalfa hay	Soybeans
	Bu	Bu	Ton	Bu
1----- Asher	35	55	4.5	30
2----- Aydelotte	20	20	---	---
3----- Bates	30	45	---	25
4----- Bates	25	40	---	20
5----- Bates	20	35	---	15
6----- Chickasha	25	40	---	20
7----- Dennis	25	50	---	20
8----- Dougherty	20	25	---	---
9----- Eram	---	---	---	---
10----- Eufaula	20	25	---	---
11----- Eufaula	---	---	---	---
12----- Gaddy	20	30	3.0	20
13----- Gowton	35	65	4.0	30
14----- Gowton	---	---	---	---
15----- Gracemont	---	---	---	---
16----- Gracemore	---	---	---	---
17----- Grainola	---	---	---	---
18----- Grainola	---	---	---	---
19----- Harjo	---	---	---	---
20----- Keokuk	35	65	4.5	30
21----- Konawa	30	50	2.5	25
22----- Konawa	25	40	2.5	20

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Wheat	Grain sorghum	Alfalfa hay	Soybeans
	Bu	Bu	Ton	Bu
23------------------------ Konawa	20	35	1.5	---
24------------------------ Konawa	---	---	---	---
25------------------------ Madill	30	50	3.5	25
26------------------------ Newtonia	30	45	3.0	30
27------------------------ Niotaze	---	---	---	---
28------------------------ Niotaze	---	---	---	---
29*. Oil-waste land				
30------------------------ Okemah	35	60	4.0	30
31------------------------ Okemah	30	65	4.0	25
32------------------------ Okemah	20	35	---	15
33* Pits				
34------------------------ Prue	30	60	---	25
35------------------------ Prue	25	50	---	20
36------------------------ Roebuck	25	50	---	---
37------------------------ Seminole	25	35	---	25
38------------------------ Seminole	15	25	---	15
39------------------------ Seminole	---	---	---	---
40------------------------ Seminole	---	---	---	---
41------------------------ Shidler	---	---	---	---
42------------------------ Stephenville	30	45	---	20
43------------------------ Stephenville	25	35	---	15
44------------------------ Stephenville	---	---	---	---
45------------------------ Stephenville	---	---	---	---

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Wheat	Grain sorghum	Alfalfa hay	Soybeans
	Bu	Bu	Ton	Bu
46-------------------------- Teller	30	50	3.0	25
47-------------------------- Teller	25	40	2.5	20
48-------------------------- Tullahassee	---	---	---	---
49-------------------------- Waurika	25	40	2.5	---
50-------------------------- Wynona	35	70	5.0	35
51-------------------------- Yahola	30	50	3.5	25

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation are listed]

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
1-Asher	Loamy Bottomland	Favorable	8,000	Big bluestem	25
		Normal	5,600	Switchgrass	15
		Unfavorable	4,000	Indiangrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Sunflower	5
				Eastern cottonwood	5
				Sedge	5
2-Aydelotte	Claypan Prairie	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	20
		Unfavorable	2,000	Switchgrass	15
				Indiangrass	10
				Sideoats grama	5
				Blue grama	5
				Buffalograss	5
				Leadplant	5
				Goldenrod	5
				Indiancurrant coralberry	5
3, 4-Bates	Loamy Prairie	Favorable	7,000	Big bluestem	35
		Normal	5,500	Little bluestem	25
		Unfavorable	4,500	Indiangrass	12
				Switchgrass	5
				Leadplant	5
5*:					
Bates	Loamy Prairie	Favorable	7,000	Big bluestem	35
		Normal	5,500	Little bluestem	25
		Unfavorable	4,500	Indiangrass	12
				Switchgrass	5
				Leadplant	5
Coweta	Shallow Prairie	Favorable	3,500	Little bluestem	30
		Normal	2,300	Big bluestem	15
		Unfavorable	1,500	Indiangrass	10
				Switchgrass	10
				Tall dropseed	10
				Scribner panicum	5
				Sideoats grama	5
				Prairie-clover	5
				Dotted gayfeather	5
6-Chickasha	Loamy Prairie	Favorable	6,000	Little bluestem	25
		Normal	4,200	Big bluestem	20
		Unfavorable	3,000	Indiangrass	10
				Switchgrass	10
				Canada wildrye	5
				Sideoats grama	5
				Blue grama	5
				Tall dropseed	5
7-Dennis	Loamy Prairie	Favorable	7,000	Big bluestem	35
		Normal	5,500	Switchgrass	15
		Unfavorable	4,500	Little bluestem	10
				Indiangrass	10
				Scribner panicum	5
				Purpletop	5
				Tall dropseed	5
				Catclaw sensitivebrier	5
				Goldenrod	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
8: Dougherty	Deep Sand Savannah	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	10
		Unfavorable	2,000	Sand bluestem	10
				Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Arrowfeather threeawn	5
				Scribner panicum	5
				Sideoats grama	5
				Lespedeza	5
9*:					
Eram	Loamy Prairie	Favorable	6,000	Big bluestem	30
		Normal	4,200	Little bluestem	15
		Unfavorable	3,000	Switchgrass	15
				Indiangrass	10
				Scribner panicum	5
				Purpletop	5
				Tall dropseed	5
				Catclaw sensitivebrier	5
				Goldenrod	5
Coweta	Shallow Prairie	Favorable	3,500	Little bluestem	30
		Normal	2,300	Big bluestem	15
		Unfavorable	1,500	Indiangrass	10
				Switchgrass	10
				Tall dropseed	10
				Scribner panicum	5
				Sideoats grama	5
				Prairie-clover	5
				Dotted gayfeather	5
10*, 11*:					
Eufaula	Deep Sand Savannah	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	10
		Unfavorable	2,000	Sand bluestem	10
				Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Arrowfeather threeawn	5
				Scribner panicum	5
				Sideoats grama	5
				Lespedeza	5
Dougherty	Deep Sand Savannah	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	10
		Unfavorable	2,000	Sand bluestem	10
				Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Arrowfeather threeawn	5
				Scribner panicum	5
				Sideoats grama	5
				Lespedeza	5
12: Gaddy	Sandy Bottomland	Favorable	3,800	Switchgrass	30
		Normal	2,700	Sand bluestem	15
		Unfavorable	2,000	Indiangrass	15
				Little bluestem	5
				Texas bluegrass	5
				Beaked panicum	5
				Purpletop	5
				Goldenrod	5
				Heath aster	5
				Maximilian sunflower	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
13, 14*: Gowton	Loamy Bottomland	Favorable	8,500	Indiangrass	15
		Normal	6,100	Little bluestem	15
		Unfavorable	4,500	Big bluestem	25
				Beaked panicum	5
				Sedge	5
				Switchgrass	15
15: Gracemont	Subirrigated	Favorable	9,000	Switchgrass	25
		Normal	7,800	Big bluestem	20
		Unfavorable	7,000	Indiangrass	10
				Eastern gamagrass	10
				Canada wildrye	5
				Maximilian sunflower	5
16: Gracemore	Subirrigated	Favorable	9,000	Switchgrass	25
		Normal	7,500	Big bluestem	20
		Unfavorable	7,000	Indiangrass	10
				Eastern gamagrass	10
				Beaked panicum	10
				Canada wildrye	5
				Scribner panicum	5
				Purpletop	5
				Maximilian sunflower	5
17*:					
Grainola	Eroded Clay	Favorable	2,000	Sideoats grama	30
		Normal	1,400	Blue grama	15
		Unfavorable	1,000	Buffalograss	15
				Little bluestem	10
Aydelotte	Eroded Clay	Favorable	2,000	Sideoats grama	30
		Normal	1,400	Blue grama	15
		Unfavorable	1,000	Buffalograss	15
				Little bluestem	10
18*:					
Grainola	Shallow Prairie	Favorable	4,000	Little bluestem	30
		Normal	2,800	Big bluestem	15
		Unfavorable	2,000	Indiangrass	10
				Switchgrass	10
				Tall dropseed	5
				Scribner panicum	5
				Sideoats grama	5
				Praire-clover	5
Lucien	Shallow Prairie	Favorable	3,000	Little bluestem	30
		Normal	2,100	Big bluestem	15
		Unfavorable	1,500	Indiangrass	10
				Switchgrass	10
				Tall dropseed	10
				Scribner panicum	5
				Sideoats grama	5
				Prairie-clover	5
				Dotted gayfeather	5
19: Harjo	Wetland	Favorable	4,500	Bushy bluestem	20
		Normal	3,600	Willow	15
		Unfavorable	3,000	Eastern cottonwood	15
				Switchgrass	10
				Indiangrass	5
				Big bluestem	5
				Little bluestem	5
				Beaked panicum	5
				Sedge	5
				Cattail	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
20 Keokuk	Loamy Bottomland	Favorable	8,500	Big bluestem	25
		Normal	6,100	Indiangrass	15
		Unfavorable	4,500	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Florida paspalum	5
				Canada wildrye	5
				Maximilian sunflower	5
				Eastern cottonwood	5
21, 22, 23 Konawa	Sandy Savannah	Favorable	4,500	Little bluestem	25
		Normal	3,800	Big bluestem	20
		Unfavorable	2,500	Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Scribner panicum	5
24 Konawa	Eroded Sandy Savannah	Favorable	2,500	Little bluestem	30
		Normal	1,600	Indiangrass	10
		Unfavorable	1,250	Splitbeard bluestem	10
				Big bluestem	5
				Switchgrass	5
				Purpletop	5
				Purple lovegrass	5
				Carolina jointtail	5
25 Madill	Loamy Bottomland	Favorable	7,000	Switchgrass	20
		Normal	6,100	Sedge	10
		Unfavorable	4,500	Panicum	5
				Little bluestem	5
				Big bluestem	10
				Indiangrass	15
26*:					
Newtonia	Loamy Prairie	Favorable	7,000	Big bluestem	35
		Normal	4,500	Indiangrass	15
		Unfavorable	3,200	Little bluestem	10
				Switchgrass	10
				Scribner panicum	5
Catoosa	Loamy Prairie	Favorable	6,500	Little bluestem	25
		Normal	5,000	Big bluestem	20
		Unfavorable	4,000	Indiangrass	10
				Switchgrass	10
				Canada wildrye	5
				Sideoats grama	5
				Blue grama	5
				Tall dropseed	5
				Lespedeza	5
				Dotted gayfeather	5
27*:					
Niotaze	Sandy Savannah	Favorable	5,500	Little bluestem	25
		Normal	4,500	Big bluestem	20
		Unfavorable	3,500	Post oak	20
				Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Hairy sunflower	5
				Blackjack oak	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
27*:					
Darnell	Shallow Savannah	Favorable	3,200	Little bluestem	30
		Normal	2,100	Big bluestem	20
		Unfavorable	1,400	Indiangrass	5
				Switchgrass	5
				Sideoats grama	5
				Purpletop	5
				Scribner panicum	5
				Tall dropseed	5
				Hairy sunflower	5
28*:					
Niotaze	Sandy Savannah	Favorable	5,500	Little bluestem	25
		Normal	4,500	Big bluestem	20
		Unfavorable	3,500	Post oak	20
				Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Hairy sunflower	5
				Blackjack oak	5
Wewoka	Shallow Savannah	Favorable	3,800	Little bluestem	25
		Normal	2,660	Big bluestem	20
		Unfavorable	1,900	Indiangrass	5
				Switchgrass	5
				Sand lovegrass	5
				Scribner panicum	5
				Purpletop	5
				Sunflower	5
				Goldenrod	5
30, 31 Okemah	Loamy Prairie	Favorable	7,000	Big bluestem	35
		Normal	5,500	Switchgrass	15
		Unfavorable	4,500	Little bluestem	10
				Indiangrass	10
				Scribner panicum	5
				Purpletop	5
				Tall dropseed	5
				Catclaw sensitivebrier	5
				Goldenrod	5
32*:					
Okemah	Loamy Prairie	Favorable	7,000	Big bluestem	35
		Normal	5,500	Switchgrass	15
		Unfavorable	4,500	Little bluestem	10
				Indiangrass	10
				Scribner panicum	5
				Purpletop	5
				Tall dropseed	5
				Catclaw sensitivebrier	5
				Goldenrod	5
Carytown	Shallow Claypan	Favorable	3,500	Little bluestem	25
		Normal	2,300	Big bluestem	15
		Unfavorable	1,500	Switchgrass	5
				Indiangrass	10
				Sideoats grama	10
				Blue grama	5
				Buffalograss	5
				Lead plant	5
				Golden rod	5
34, 35 Prue	Loamy Prairie	Favorable	7,000	Big bluestem	35
		Normal	5,200	Little bluestem	10
		Unfavorable	4,000	Indiangrass	10
				Switchgrass	15
				Scribner panicum	5
				Tall dropseed	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
36: Roebuck	Heavy Bottomland	Favorable	7,000	Switchgrass	20
		Normal	4,600	Big bluestem	15
		Unfavorable	3,000	Sedge	10
				Florida paspalum	5
				Prairie cordgrass	5
37, 38: Seminole	Loamy Prairie	Favorable	5,000	Little bluestem	25
		Normal	3,500	Big bluestem	20
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	10
				Canada wildrye	5
				Sideoats grama	5
				Blue grama	5
				Tall dropseed	5
39*:					
Seminole	Eroded Prairie	Favorable	3,000	Little bluestem	35
		Normal	2,100	Big bluestem	10
		Unfavorable	1,500	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
				Blue grama	5
				Tall dropseed	5
Chickasha	Eroded Prairie	Favorable	3,500	Little bluestem	35
		Normal	2,600	Big bluestem	10
		Unfavorable	1,800	Sideoats grama	10
				Tall dropseed	10
				Indiangrass	5
				Switchgrass	5
				Blue grama	5
Prue	Eroded Prairie	Favorable	3,200	Big bluestem	10
		Normal	2,200	Little bluestem	25
		Unfavorable	1,500	Indiangrass	10
				Switchgrass	5
				Scribner panicum	5
				Tall dropseed	10
				Sideoats grama	5
40*:					
Seminole	Loamy Prairie	Favorable	5,000	Little bluestem	25
		Normal	3,500	Big bluestem	20
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	10
				Canada wildrye	5
				Sideoats grama	5
				Blue grama	5
				Tall dropseed	5
Gowton	Loamy Bottomland	Favorable	8,500	Indiangrass	15
		Normal	6,100	Little bluestem	15
		Unfavorable	4,500	Big bluestem	25
				Beaked panicum	5
				Sedge	5
				Switchgrass	15
41*:					
Shidler	Very Shallow	Favorable	2,500	Sideoats grama	30
		Normal	1,300	Little bluestem	25
		Unfavorable	500	Big bluestem	5
				Hairy grama	5
				Purple prairie-clover	5
				Threeawn	5
Rock outcrop.					

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
42, 43 Stephenville	Sandy Savannah	Favorable	5,000	Little bluestem	25
		Normal	3,800	Big bluestem	20
		Unfavorable	3,000	Indiangrass	5
				Switchgrass	5
				Sand lovegrass	5
				Scribner panicum	5
				Purpletop	5
				Sunflower	5
				Goldenrod	5
44*:					
Stephenville	Sandy Savannah	Favorable	4,500	Little bluestem	25
		Normal	3,300	Big bluestem	20
		Unfavorable	2,500	Indiangrass	5
				Switchgrass	5
				Sand lovegrass	5
				Scribner panicum	5
				Purpletop	5
				Sunflower	5
				Goldenrod	5
Darnell	Shallow Savannah	Favorable	3,200	Little bluestem	30
		Normal	2,100	Big bluestem	20
		Unfavorable	1,400	Indiangrass	5
				Switchgrass	5
				Sideoats grama	5
				Purpletop	5
				Scribner panicum	5
				Tall dropseed	5
				Hairy sunflower	5
45*:					
Stephenville	Eroded Sandy Savannah	Favorable	2,200	Little bluestem	30
		Normal	1,500	Indiangrass	10
		Unfavorable	1,100	Big bluestem	5
				Switchgrass	5
				Purpletop	5
				Tickclover	5
Darnell	Eroded Shallow Savannah	Favorable	1,700	Little bluestem	35
		Normal	1,200	Indiangrass	15
		Unfavorable	800	Purpletop	10
				Big bluestem	5
				Switchgrass	5
				Scribner panicum	5
46, 47 Teller	Loamy Prairie	Favorable	6,500	Little bluestem	25
		Normal	4,700	Big bluestem	20
		Unfavorable	3,500	Indiangrass	10
				Switchgrass	10
				Canada wildrye	5
				Sideoats grama	5
				Blue grama	5
				Tall dropseed	5
				Dotted gayfeather	5
48 Tullahassee	Subirrigated	Favorable	9,000	Giant cane	15
		Normal	7,800	Switchgrass	10
		Unfavorable	7,000	Indiangrass	10
				Eastern gamagrass	10
				Wildrye	10
				Panicum	10
				Big bluestem	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Compo- sition
		Kind of year	Dry weight		
			Lb/acre		Pct
49: Waurika	Claypan Prairie	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	20
		Unfavorable	2,000	Switchgrass	15
				Indiangrass	10
				Sideoats grama	5
				Blue grama	5
				Buffalograss	5
				Leadplant	5
				Goldenrod	5
				Indiancurrant coralberry	5
50: Wynona	Loamy Bottomland	Favorable	10,000	Switchgrass	25
		Normal	8,800	Indiangrass	20
		Unfavorable	8,000	Big bluestem	15
				Little bluestem	10
				Eastern gamagrass	5
				Sedge	5
				Compassplant	5
51: Yahola	Loamy Bottomland	Favorable	7,000	Big bluestem	25
		Normal	4,900	Indiangrass	15
		Unfavorable	3,500	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Beaked panicum	5
				Compassplant	5
				Sedge	5
				Heath aster	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[Absence of an entry indicates that expected height data were not available or that the species does not grow well on the soil]

Soil name and map symbol	Expected heights of specified trees at 20 years of age							
	Red mulberry	Autumn-olive	Eastern cotton-wood	Eastern redcedar	Loblolly pine	Osage-orange	Austrian pine	Shortleaf pine
	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft
1. Asher	35	---	80	35	40	---	35	35
2. Aydelotte	---	---	---	20	---	20	---	---
3, 4. Bates	25	---	60	25	35	---	25	30
5*:								
Bates	25	---	60	25	35	---	25	30
Coweta	---	---	---	15	---	---	---	---
6. Chickasha	25	---	60	25	35	---	25	30
7. Dennis	---	---	---	25	---	25	---	---
8. Dougherty	30	---	65	30	40	---	30	35
9*:								
Eram	---	---	---	20	---	20	---	---
Coweta	---	---	---	15	---	---	---	---
10*, 11*:								
Eufaula	20	---	---	20	---	---	---	---
Dougherty	30	---	65	30	40	---	25	35
12. Gaddy	25	---	65	30	---	---	---	---
13, 14*. Gowton	35	---	80	35	40	---	35	35
15. Gracemont	---	---	90	35	40	---	35	35
16. Gracemore	---	---	90	35	40	---	35	35
17*:								
Grainola	---	---	---	15	---	15	---	---
Aydelotte	---	---	---	20	---	20	---	---
18*:								
Grainola	---	---	---	15	---	15	---	---
Lucien	---	---	---	15	---	---	---	---
19. Harjo	---	---	80	20	---	20	---	---
20. Keokuk	35	---	80	35	40	---	35	35
21, 22, 23, 24. Konawa	30	---	65	30	40	---	30	35

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Expected heights of specified trees at 20 years of age							
	Red mulberry	Autumn-olive	Eastern cotton-wood	Eastern redcedar	Loblolly pine	Osage-orange	Austrian pine	Shortleaf pine
	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft
25. Madill	30	--	70	30	35	--	30	30
26*: Newtonia.	30	--	60	30	35	--	30	35
Catoosa	25	--	55	25	30	--	25	30
27*: Niotaze.								
Darnell.								
28*: Niotaze	--	--	--	20	--	20	--	--
Wewoka	20	--	--	20	--	--	--	--
29*. Oil-waste land								
30, 31. Okemah	--	--	--	25	--	25	--	--
32*: Okemah	--	--	--	25	--	25	--	--
Carytown	--	--	--	15	--	--	--	--
33*. Pits								
34, 35. Prue	30	--	60	30	35	--	30	35
36. Roebuck	--	--	60	25	--	25	--	--
37, 38. Seminole	--	--	--	15	--	15	--	--
39*: Seminole	--	--	--	15	--	15	--	--
Chickasha	25	--	60	25	35	--	25	30
Prue	30	--	60	30	35	--	30	35
40*: Seminole	--	--	--	15	--	15	--	--
Gowton	35	--	80	35	40	--	35	35
41*: Shidler	--	--	--	15	--	--	--	--
Rock outcrop.								
42, 43. Stephenville	25	--	60	25	35	--	25	30
44*, 45*: Stephenville	25	--	60	25	35	--	25	30
Darnell	--	--	--	15	--	--	--	--
46, 47. Teller	30	--	65	30	40	--	30	35

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Expected heights of specified trees at 20 years of age							
	Red mulberry	Autumn-olive	Eastern cotton-wood	Eastern redcedar	Loblolly pine	Osage-orange	Austrian pine	Shortleaf pine
	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft
48------------------- Tullahassee	--	--	90	35	40	--	35	35
49------------------- Waurika	--	--	--	20	--	--	--	--
50------------------- Wynona	--	--	90	35	40	--	35	35
51------------------- Yahola	35	--	70	35	40	--	30	35

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1: Asher	Moderate: wetness, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength.
2: Aydelotte	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
3: Bates	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
4: Bates	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.
5*:					
Bates	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.
Coweta	Moderate: slope, depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.
6: Chickasha	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
7: Dennis	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
8: Dougherty	Moderate: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: low strength.
9*:					
Eram	Severe: too clayey, wetness.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Coweta	Moderate: slope, depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: depth to rock, slope.
10*:					
Eufaula	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Dougherty	Moderate: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength.
11*:					
Eufaula	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Dougherty	Moderate: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: slope.
12: Gaddy	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
13----------------- Gowton	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
14*---------------- Gowton	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
15----------------- Gracemont	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods.
16----------------- Gracemore	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods.
17*:					
Grainola----------	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, slope, shrink-swell.	Severe: low strength, shrink-swell.
Aydelotte---------	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
18*:					
Grainola----------	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, slope, shrink-swell.	Severe: low strength, shrink-swell.
Lucien------------	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: slope.	Moderate: depth to rock.
19----------------- Harjo	Severe: too clayey, wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.
20----------------- Keokuk	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
21----------------- Konawa	Slight------------	Slight------------	Slight------------	Slight-------------	Moderate: low strength.
22----------------- Konawa	Slight------------	Slight------------	Slight------------	Moderate: slope.	Moderate: low strength.
23----------------- Konawa	Slight------------	Slight------------	Slight------------	Slight-------------	Moderate: low strength.
24----------------- Konawa	Slight------------	Slight------------	Slight------------	Moderate: slope.	Moderate: low strength.
25----------------- Madill	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
26*:					
Newtonia----------	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
26*:					
Catoosa	Severe: depth to rock.	Moderate: low strength, depth to rock, shrink-swell.	Severe: depth to rock.	Moderate: low strength, depth to rock, shrink-swell.	Severe: low strength.
27*:					
Niotaze	Severe: wetness, slope.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, slope, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
Darnell	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: slope.
28*:					
Niotaze	Severe: wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell.
Wewoka	Moderate: depth to rock, cutbanks cave.	Slight	Moderate: depth to rock.	Moderate: slope.	Slight.
29*. Oil-waste land					
30, 31 Okemah	Severe: too clayey, wetness.	Severe: low strength, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
32*:					
Okemah	Severe: too clayey, wetness.	Severe: low strength, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Carytown	Severe: wetness, too clayey.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.
33*. Pits					
34, 35 Prue	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
36 Roebuck	Severe: floods, too clayey.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.
37, 38 Seminole	Severe: too clayey, wetness.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell, wetness.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
39*:					
Seminole	Severe: too clayey, wetness.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell, wetness.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Chickasha	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
39*:					
Prue	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
40*:					
Seminole	Severe: too clayey, wetness.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell, wetness.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Gowton	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
41*:					
Shidler	Severe: depth to rock.	Severe: depth to rock, low strength.	Severe: depth to rock, low strength.	Severe: depth to rock, low strength.	Severe: depth to rock, low strength.
Rock outcrop.					
42 Stephenville	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Moderate: low strength.
43 Stephenville	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Moderate: low strength.
44*, 45*:					
Stephenville	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope, low strength.
Darnell	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: depth to rock, slope, low strength.
46 Teller	Slight	Slight	Slight	Slight	Moderate: low strength.
47 Teller	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
48 Tullahassee	Severe: wetness, floods.	Severe: floods.	Severe: wetness, floods.	Severe: floods.	Severe: floods.
49 Waurika	Severe: wetness, too clayey.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: low strength, shrink-swell.
50 Wynona	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods, low strength.
51 Yahola	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," and "fair."" Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1---------------- Asher	Moderate: floods.	Moderate: seepage.	Moderate: floods.	Moderate: floods.	Fair: too clayey.
2---------------- Aydelotte	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: thin layer.
3, 4------------- Bates	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----------	Fair: thin layer.
5*:					
Bates------------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----------	Fair: thin layer.
Coweta-----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----------	Poor: thin layer.
6---------------- Chickasha	Moderate: depth to rock.	Moderate: seepage, depth to rock.	Moderate: depth to rock.	Slight-----------	Good.
7---------------- Dennis	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Severe: wetness.	Poor: thin layer.
8---------------- Dougherty	Slight-----------	Severe: seepage.	Severe: seepage.	Slight-----------	Fair: too sandy.
9*:					
Eram-------------	Severe: percs slowly, wetness, depth to rock.	Severe: depth to rock.	Severe: too clayey.	Severe: wetness.	Poor: thin layer.
Coweta-----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer.
10*:					
Eufaula----------	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Dougherty--------	Slight-----------	Severe: seepage.	Severe: seepage.	Slight-----------	Fair: too sandy.
11*:					
Eufaula----------	Moderate: slope.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
Dougherty--------	Moderate: slope.	Severe: seepage.	Severe: seepage.	Moderate: slope.	Fair: too sandy.
12--------------- Gaddy	Severe: floods.	Severe: seepage, floods.	Severe: seepage, too sandy, floods.	Severe: floods, seepage.	Fair: too sandy.
13, 14*---------- Gowton	Severe: floods.	Moderate: seepage.	Severe: floods.	Severe: floods.	Good.
15--------------- Gracemont	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: floods, seepage.	Severe: wetness, floods, seepage.	Good.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
16------------------ Gracemore	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: floods, seepage, wetness.	Severe: wetness, floods, seepage.	Poor: too sandy.
17*:					
Grainola-----------	Severe: percs slowly, depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Moderate: slope.	Poor: too clayey.
Aydelotte----------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: thin layer.
18*:					
Grainola-----------	Severe: percs slowly, depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Moderate: slope.	Poor: too clayey.
Lucien-------------	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: thin layer.
19------------------ Harjo	Severe: wetness, floods, percs slowly.	Severe: wetness, floods.	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: too clayey, wetness.
20------------------ Keokuk	Moderate: floods.	Moderate: seepage.	Moderate: floods, seepage.	Moderate: floods.	Good.
21, 22, 23, 24------ Konawa	Slight-----------	Severe: seepage.	Severe: seepage.	Slight-----------	Good.
25------------------ Madill	Severe: floods.	Severe: seepage, floods.	Severe: seepage, floods.	Severe: floods, seepage.	Good.
26*:					
Newtonia-----------	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight-----------	Fair: too clayey.
Catoosa------------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----------	Fair: thin layer.
27*:					
Niotaze------------	Severe: depth to rock, percs slowly, wetness.	Severe: slope.	Severe: wetness, depth to rock.	Severe: slope.	Poor: too clayey, slope, area reclaim.
Darnell------------	Severe: depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, large stones.	Severe: seepage, slope.	Poor: thin layer, large stones.
28*:					
Niotaze------------	Severe: depth to rock, percs slowly, wetness.	Severe: slope.	Severe: wetness, depth to rock.	Severe: wetness.	Poor: too clayey, area reclaim.
Wewoka-------------	Severe: depth to rock.	Severe: seepage, depth to rock, small stones.	Severe: seepage, small stones, depth to rock.	Severe: seepage.	Poor: small stones.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
29* Oil-waste land					
30 Okemah	Severe: percs slowly, wetness.	Slight	Severe: too clayey.	Severe: wetness.	Fair: thin layer.
31 Okemah	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Severe: wetness.	Fair: thin layer.
32*: Okemah	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Severe: wetness.	Fair: thin layer.
Carytown	Severe: percs slowly, wetness.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, wetness, hard to pack.
33* Pits					
34, 35 Prue	Severe: percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey.
36 Roebuck	Severe: percs slowly, floods.	Severe: floods.	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey, hard to pack.
37, 38 Seminole	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey, wetness.	Moderate: wetness.	Poor: too clayey.
39*: Seminole	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey, wetness.	Moderate: wetness.	Poor: too clayey.
Chickasha	Moderate: depth to rock.	Moderate: seepage, depth to rock.	Moderate: depth to rock.	Slight	Good.
Prue	Severe: percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey.
40*: Seminole	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey, wetness.	Moderate: wetness.	Poor: too clayey.
Gowton	Severe: floods.	Moderate: seepage.	Severe: floods.	Severe: floods.	Good.
41* Shidler	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.
Rock outcrop.					
42, 43 Stephenville	Severe: depth to rock.	Severe: depth to rock, slope.	Moderate: depth to rock.	Slight	Fair: thin layer.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
44*, 45*:					
Stephenville	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Moderate: depth to rock.	Moderate: slope.	Fair: thin layer, slope.
Darnell	Severe: depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: thin layer, slope.
46, 47 Teller	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
48 Tullahassee	Severe: floods, wetness.	Severe: wetness, floods, seepage.	Severe: floods, wetness, seepage.	Severe: wetness, floods, seepage.	Good.
49 Waurika	Severe: percs slowly, wetness.	Slight	Severe: too clayey.	Severe: wetness.	Poor: thin layer.
50 Wynona	Severe: percs slowly, wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Fair: too clayey.
51 Yahola	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1: Asher	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
2: Aydelotte	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
3, 4: Bates	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
5*:				
Bates	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Coweta	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
6: Chickasha	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
7: Dennis	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
8: Dougherty	Fair: low strength.	Poor	Unsuited: excess fines.	Poor: too sandy.
9*:				
Eram	Poor: low strength, shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
Coweta	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
10*:				
Eufaula	Fair: low strength.	Poor	Unsuited: excess fines.	Poor: too sandy.
Dougherty	Fair: low strength.	Poor	Unsuited: excess fines.	Poor: too sandy.
11*:				
Eufaula	Good	Poor	Unsuited: excess fines.	Poor: too sandy.
Dougherty	Fair: low strength.	Poor	Unsuited: excess fines.	Poor: too sandy.
12: Gaddy	Good	Poor	Unsuited: excess fines.	Poor: too sandy.
13, 14*: Gowton	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
15: Gracemont	Fair: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
16-------------------- Gracemore	Fair: low strength, wetness.	Poor------------------	Unsuited: excess fines.	Poor: too sandy.
17*:				
Grainola--------------	Poor: low strength, shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Aydelotte-------------	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
18*:				
Grainola--------------	Poor: low strength, shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Lucien----------------	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
19-------------------- Harjo	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
20-------------------- Keokuk	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
21, 22, 23, 24-------- Konawa	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
25-------------------- Madill	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
26*:				
Newtonia--------------	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Catoosa---------------	Poor: low strength.	Unsuited: excess fines	Unsuited: excess fines.	Fair: thin layer.
27*:				
Niotaze---------------	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones, slope.
Darnell---------------	Fair: thin layer, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones, slope.
28*:				
Niotaze---------------	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
Wewoka----------------	Poor: thin layer.	Poor: excess fines.	Fair: excess fines.	Poor: small stones.
29* Oil-waste land				
30, 31---------------- Okemah	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
32*:				
Okemah	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Carytown	Poor: shrink-swell, wetness, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim, wetness, excess sodium.
33*. Pits				
34, 35 Prue	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
36 Roebuck	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
37, 38 Seminole	Severe: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
39*:				
Seminole	Severe: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Chickasha	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Prue	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
40*:				
Seminole	Severe: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Gowton	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
41*:				
Shidler	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim.
Rock outcrop.				
42, 43 Stephenville	Fair: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
44*, 45*:				
Stephenville	Fair: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
Darnell	Fair: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
46, 47 Teller	Good	Unsuited: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
48-------------------- Tullahassee	Fair: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
49-------------------- Waurika	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
50-------------------- Wynona	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
51-------------------- Yahola	Fair: low strength.	Poor-----------------	Unsuited: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
1 Asher	Moderate: seepage.	Moderate: unstable fill, compressible, piping.	Severe: deep to water.	Floods	Favorable	Favorable.
2 Aydelotte	Slight	Moderate: unstable fill, compressible.	Severe: no water.	Not needed	Erodes easily, percs slowly.	Erodes easily, percs slowly.
3, 4 Bates	Moderate: depth to rock, erodes easily.	Moderate: thin layer.	Severe: no water.	Not needed	Slope, depth to rock, erodes easily.	Slope, erodes easily, rooting depth.
5*:						
Bates	Moderate: depth to rock, erodes easily.	Moderate: thin layer.	Severe: no water.	Not needed	Slope, depth to rock, erodes easily.	Slope, erodes easily, rooting depth.
Coweta	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Not needed	Depth to rock, rooting depth, slope.	Droughty, rooting depth, slope.
6 Chickasha	Moderate: depth to rock, seepage.	Moderate: thin layer.	Severe: deep to water.	Not needed	Erodes easily	Erodes easily.
7 Dennis	Slight	Moderate: unstable fill, compressible, piping.	Severe: no water.	Percs slowly	Percs slowly	Percs slowly.
8 Dougherty	Severe: seepage.	Moderate: unstable fill, compressible, piping.	Severe: no water.	Not needed	Erodes easily, too sandy.	Erodes easily, fast intake.
9*:						
Eram	Slight	Moderate: unstable fill, thin layer.	Severe: no water.	Percs slowly	Percs slowly	Percs slowly.
Coweta	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Not needed	Depth to rock, rooting depth, slope.	Droughty, rooting depth, slope.
10* 11*:						
Eufaula	Severe: seepage.	Moderate: unstable fill, piping.	Severe: no water.	Not needed	Seepage, fast intake, droughty.	Erodes easily, droughty, fast intake.
Dougherty	Severe: seepage.	Moderate: unstable fill, compressible, piping.	Severe: no water.	Not needed	Erodes easily, too sandy.	Erodes easily, fast intake.
12 Gaddy	Severe: seepage.	Moderate: unstable fill, piping.	Severe: deep to water.	Not needed	Erodes easily	Erodes easily.
13, 14* Gowton	Moderate: seepage.	Moderate: unstable fill, piping.	Severe: deep to water.	Not needed	Not needed	Not needed.
15 Gracemont	Severe: seepage.	Moderate: unstable fill, piping.	Moderate: deep to water.	Floods	Not needed	Wetness, seepage.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
16----------------- Gracemore	Severe: seepage.	Moderate: unstable fill, low strength, piping.	Moderate: deep to water.	Floods, cutbanks cave.	Not needed-----	Wetness, seepage.
17*:						
Grainola----------	Slight----------	Severe: compressible, shrink-swell.	Severe: no water.	Not needed-----	Percs slowly, slope.	Percs slowly, slope.
Aydelotte---------	Slight----------	Moderate: unstable fill, compressible.	Severe: no water.	Not needed-----	Erodes easily, percs slowly.	Erodes easily, percs slowly.
18*:						
Grainola----------	Slight----------	Severe: compressible, shrink-swell.	Severe: no water.	Not needed-----	Percs slowly, slope.	Percs slowly, slope.
Lucien------------	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Not needed-----	Not needed-----	Not needed.
19----------------- Harjo	Slight----------	Moderate: compressible, unstable fill.	Moderate: slow refill.	Floods, percs slowly.	Wetness---------	Wetness.
20----------------- Keokuk	Moderate: seepage.	Moderate: piping, compressible, low strength.	Severe: no water.	Not needed-----	Favorable-------	Favorable.
21, 22, 23, 24----- Konawa	Severe: seepage.	Moderate: low strength, unstable fill, piping.	Severe: deep to water.	Not needed-----	Erodes easily	Erodes easily.
25----------------- Madill	Severe: seepage.	Moderate: unstable fill, seepage, piping.	Severe: deep to water.	Not needed-----	Seepage---------	Seepage.
26*:						
Newtonia----------	Moderate: seepage.	Moderate: compressible, unstable fill.	Severe: no water.	Not needed-----	Favorable-------	Favorable.
Catoosa-----------	Severe: depth to rock.	Moderate: unstable fill, piping, thin layer.	Severe: no water.	Not needed-----	Depth to rock, rooting depth, droughty.	Rooting depth, droughty.
27*:						
Niotaze-----------	Moderate: depth to rock.	Moderate: wetness, thin layer, hard to pack.	Moderate: slow refill.	Percs slowly, depth to rock, slope.	Slope, wetness, percs slowly.	Slope, wetness, depth to rock.
Darnell-----------	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Not needed-----	Slope-----------	Slope.
28*:						
Niotaze-----------	Moderate: depth to rock.	Moderate: wetness, thin layer, hard to pack.	Moderate: slow refill.	Percs slowly, depth to rock, slope.	Percs slowly, wetness.	Wetness, depth to rock.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
28*. Wewoka	Severe: seepage, depth to rock.	Moderate: piping, hard to pack, thin layer.	Severe: no water.	Not needed	Slope	Slope.
29*. Oil-waste land						
30, 31 Okemah	Slight	Moderate: unstable fill.	Severe: no water.	Percs slowly	Percs slowly	Percs slowly.
32*: Okemah	Slight	Moderate: unstable fill.	Severe: no water.	Percs slowly	Percs slowly	Percs slowly.
Carytown	Slight	Severe: excess salt.	Severe: no water.	Percs slowly, excess sodium.	Percs slowly, wetness, erodes easily.	Percs slowly, wetness, excess sodium.
33*. Pits						
34, 35 Prue	Moderate: seepage.	Moderate: unstable fill, compressible.	Severe: slow refill.	Percs slowly	Percs slowly	Percs slowly.
36 Roebuck	Slight	Moderate: compressible, unstable fill.	Severe: deep to water.	Floods, percs slowly.	Percs slowly	Percs slowly.
37, 38 Seminole	Slight	Severe: excess salt.	Severe: slow refill.	Percs slowly, excess salt, excess sodium.	Wetness, percs slowly, erodes easily.	Excess sodium, percs slowly, erodes easily.
39*: Seminole	Slight	Severe: excess salt.	Severe: slow refill.	Percs slowly, excess salt, excess sodium.	Wetness, percs slowly, erodes easily.	Excess sodium, percs slowly, erodes easily.
Chickasha	Moderate: depth to rock, seepage.	Moderate: thin layer.	Severe: deep to water.	Not needed	Erodes easily	Erodes easily.
Prue	Moderate: seepage.	Moderate: unstable fill, compressible.	Severe: slow refill.	Percs slowly	Percs slowly	Percs slowly.
40*: Seminole	Slight	Severe: excess salt.	Severe: slow refill.	Percs slowly, excess salt, excess sodium.	Wetness, percs slowly, erodes easily.	Excess sodium, percs slowly, erodes easily.
Gowton	Moderate: seepage.	Moderate: unstable fill, piping.	Severe: deep to water.	Not needed	Not needed	Not needed.
41*: Shidler	Severe: depth to rock.	Severe: depth to rock.	Severe: no water.	Not needed	Depth to rock	Rooting depth.
Rock outcrop.						
42, 43 Stephenville	Severe: depth to rock.	Moderate: thin layer.	Severe: no water.	Not needed	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
44*, 45*:						
Stephenville	Severe: depth to rock.	Moderate: thin layer.	Severe: no water.	Not needed	Slope	Slope.
Darnell	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Not needed	Slope	Slope.
46, 47 Teller	Severe: seepage.	Moderate: unstable fill, piping.	Severe: no water.	Not needed	Erodes easily, piping.	Erodes easily.
48 Tullahassee	Severe: seepage.	Moderate: unstable fill, piping.	Moderate: deep to water.	Floods	Not needed	Favorable.
49 Waurika	Slight	Moderate: compressible, unstable fill, shrink-swell.	Severe: slow refill.	Percs slowly	Not needed	Not needed.
50 Wynona	Slight	Moderate: compressible, unstable fill.	Severe: slow refill.	Floods, percs slowly.	Not needed	Wetness.
51 Yahola	Severe: seepage.	Moderate: unstable fill, seepage, piping.	Severe: deep to water.	Not needed	Not needed	Not needed.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--RECREATIONAL DEVELOPMENT

[Some terms that decribe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1: Asher	Severe: floods.	Moderate: floods, too clayey.	Moderate: floods, percs slowly, too clayey.	Moderate: too clayey.
2: Aydelotte	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
3: Bates	Slight	Slight	Moderate: slope, depth to rock.	Slight.
4: Bates	Slight	Slight	Severe: slope.	Slight.
5*:				
Bates	Slight	Slight	Moderate: slope, depth to rock.	Slight.
Coweta	Slight	Slight	Severe: depth to rock, slope, large stones.	Slight.
6: Chickasha	Slight	Slight	Moderate: slope.	Slight.
7: Dennis	Moderate: wetness, percs slowly.	Slight	Moderate: percs slowly, slope, wetness.	Slight.
8: Dougherty	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
9*:				
Eram	Moderate: percs slowly, too clayey, wetness.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
Coweta	Moderate: slope.	Moderate: slope.	Severe: depth to rock, slope, large stones.	Slight.
10*:				
Eufaula	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Dougherty	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
11*:				
Eufaula	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy.	Severe: too sandy.
Dougherty	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
12: Gaddy	Severe: floods.	Moderate: floods.	Moderate: floods.	Moderate: too sandy.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
13 Gowton	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
14* Gowton	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
15 Gracemont	Severe: floods, wetness.	Severe: floods.	Severe: floods.	Moderate: floods, wetness.
16 Gracemore	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: wetness, floods.
17*:				
Grainola	Moderate: percs slowly, slope, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
Aydelotte	Severe: percs slowly, too clayey.	Moderate: too clayey.	Severe: percs slowly, too clayey.	Moderate: too clayey.
18*:				
Grainola	Moderate: percs slowly, slope, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
Lucien	Moderate: slope.	Moderate: slope.	Severe: depth to rock.	Slight.
19 Harjo	Severe: too clayey, wetness, floods.	Severe: floods, too clayey, wetness.	Severe: wetness, floods, percs slowly.	Severe: wetness, floods, too clayey.
20 Keokuk	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
21, 22, 23, 24 Konawa	Slight	Slight	Moderate: slope.	Slight.
25 Madill	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
26*:				
Newtonia	Slight	Slight	Moderate: slope.	Slight.
Catoosa	Slight	Slight	Moderate: depth to rock.	Slight.
27*:				
Niotaze	Severe: wetness, slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.
Darnell	Severe: large stones.	Severe: slope.	Severe: depth to rock, large stones.	Severe: large stones.
28*:				
Niotaze	Severe: wetness.	Moderate: wetness, small stones.	Severe: slope, small stones.	Moderate: wetness.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
28*:				
Wewoka	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Moderate: small stones.
29*. Oil-waste land				
30 Okemah	Moderate: percs slowly, wetness.	Slight	Moderate: percs slowly, wetness.	Slight.
31 Okemah	Moderate: percs slowly, wetness.	Slight	Moderate: percs slowly, slope, wetness.	Slight.
32*:				
Okemah	Moderate: percs slowly, wetness.	Slight	Moderate: percs slowly, slope, wetness.	Slight.
Carytown	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.
33*. Pits				
34, 35 Prue	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
36 Roebuck	Severe: floods, percs slowly.	Severe: too clayey.	Severe: floods, too clayey, percs slowly.	Severe: too clayey.
37 Seminole	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: percs slowly, wetness.	Slight.
38 Seminole	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: percs slowly, slope, wetness.	Slight.
39*:				
Seminole	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: percs slowly, slope, wetness.	Slight.
Chickasha	Slight	Slight	Moderate: slope.	Slight.
Prue	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
40*:				
Seminole	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: percs slowly, slope, wetness.	Slight.
Gowton	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
41*:				
Shidler	Slight	Slight	Severe: depth to rock.	Slight.
Rock outcrop.				
42, 43 Stephenville	Slight	Slight	Moderate: slope.	Slight.
44*, 45*:				
Stephenville	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Darnell	Moderate: slope.	Moderate: slope.	Severe: depth to rock, slope.	Slight.
46, 47 Teller	Slight	Slight	Moderate: slope.	Slight.
48 Tullahassee	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: wetness, floods.
49 Waurika	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.
50 Wynona	Severe: floods, wetness.	Moderate: wetness, floods, too clayey.	Severe: floods, wetness.	Moderate: too clayey, wetness, floods.
51 Yahola	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
1------------------ Asher	Good	Good	Fair	---	---	Fair	Poor	Poor	Good	---	Poor	Fair.
2------------------ Aydelotte	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
3, 4--------------- Bates	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
5*:												
Bates--------------	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
Coweta-------------	Very poor.	Poor	Poor	Very poor.	Very poor.	---	Very poor.	Very poor.	Poor	Very poor.	Very poor.	---
6------------------ Chickasha	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
7------------------ Dennis	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
8------------------ Dougherty	Fair	Fair	Good	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Good.
9*:												
Eram---------------	Fair	Good	Fair	Good	Good	---	Poor	Very poor.	Fair	Good	Very poor.	---
Coweta-------------	Very poor.	Poor	Poor	Very poor.	Very poor.	---	Very poor.	Very poor.	Poor	Very poor.	Very poor.	---
10*:												
Eufaula------------	Fair	Fair	Fair	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Dougherty----------	Fair	Fair	Good	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Good.
11*:												
Eufaula------------	Fair	Fair	Fair	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Dougherty----------	Fair	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
12----------------- Gaddy	Fair	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
13----------------- Gowton	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
14*---------------- Gowton	Poor	Fair	Fair	Good	Good	---	Poor	Very poor.	Fair	Good	Very poor.	---
15----------------- Gracemont	Poor	Fair	Fair	Good	Good	---	Fair	Poor	Fair	Good	Poor	---
16----------------- Gracemore	Poor	Fair	Fair	Good	Good	---	Fair	Poor	Fair	Fair	Poor	---

See footnote at end of table.

TABLE 14.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
17*:												
Grainola	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Aydelotte	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
18*:												
Grainola	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Lucien	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
19 Harjo	Poor	Fair	Fair	Fair	Fair	---	Poor	Good	Fair	Fair	Fair	---
20 Keokuk	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
21, 22, 23 Konawa	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
24 Konawa	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
25 Madill	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
26*:												
Newtonia	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
Catoosa	Fair	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
27*:												
Niotaze	Poor	Fair	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Darnell	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
28*:												
Niotaze	Fair	Good	Good	---	---	Fair	Very poor.	Very poor.	Good	---	Very poor.	Fair.
Wewoka	Very poor.	Poor	Poor	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
29*. Oil-waste land												
30, 31 Okemah	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor	---
32*:												
Okemah	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor	---
Carytown	Poor	Fair	Fair	Poor	Poor	---	Good	Good	Fair	Poor	Good	---
33*. Pits												
34, 35 Prue	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---

See footnote at end of table.

TABLE 14.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
36-----------------Roebuck	Fair	Fair	Poor	Good	Good	---	Poor	Fair	Poor	Fair	Poor	---
37-----------------Seminole	Good	Good	Good	---	---	Fair	Poor	Poor	Good	---	Poor	Fair.
38-----------------Seminole	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
39*:												
Seminole-----------	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Chickasha----------	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Prue---------------	Fair	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
40*:												
Seminole-----------	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Gowton-------------	Poor	Fair	Fair	Good	Good	---	Poor	Very poor.	Fair	Good	Very poor.	---
41*:												
Shidler------------	Very poor.	Very poor.	Poor	---	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
Rock outcrop.												
42, 43-------------Stephenville	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
44*, 45*:												
Stephenville-------	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Darnell------------	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
46, 47-------------Teller	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
48-----------------Tullahassee	Very poor.	Poor	Poor	Good	Good	---	Fair	Poor	Poor	Fair	Poor	---
49-----------------Waurika	Fair	Good	Fair	---	---	Fair	Fair	Fair	Fair	---	Fair	Fair.
50-----------------Wynona	Good	Good	Good	Good	Good	---	Fair	Fair	Good	Good	Fair	---
51-----------------Yahola	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
1------------------- Asher	0-22	Silty clay loam	CL	A-7, A-6	0	100	100	95-100	90-98	37-50	15-25
	22-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4	0	100	100	85-100	51-97	<30	NP-10
2------------------- Aydelotte	0-5	Loam-------------	ML, CL	A-4, A-6	0	100	100	96-100	60-85	27-37	8-14
	5-62	Clay, silty clay, clay loam.	CH, MH, CL, ML	A-7, A-6	0	100	98-100	96-100	75-99	37-70	15-38
3------------------- Bates	0-20	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	55-90	20-40	3-15
	20-38	Loam, clay loam, sandy clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	50-85	25-40	3-15
	38-42	Weathered bedrock.	---	---	---	---	---	---	---	---	---
4------------------- Bates	0-21	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	55-90	20-40	3-15
	21-32	Loam, clay loam, sandy clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	50-85	25-40	3-15
	32-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
5*:											
Bates---------------	0-9	Fine sandy loam	ML, SM	A-4	0	100	100	90-100	40-55	<30	NP-5
	9-25	Loam, clay loam, sandy clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	50-85	25-40	3-15
	25-30	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Coweta--------------	0-9	Fine sandy loam	ML, CL, SM, SC	A-4	0-30	70-100	70-100	60-90	36-85	<31	NP-10
	9-14	Fine sandy loam, loam, clay loam.	ML, CL, SM, SC	A-2, A-4, A-6	0-25	55-75	55-75	45-70	30-65	<31	NP-12
	14-20	Weathered bedrock.	---	---	---	---	---	---	---	---	---
6------------------- Chickasha	0-10	Loam-------------	ML, CL-ML, SM, SM-SC	A-4	0	100	98-100	94-100	36-70	<26	NP-6
	10-32	Sandy clay loam, clay loam, loam.	CL, SC	A-4, A-6	0	100	100	90-100	40-70	28-39	9-18
	32-56	Sandy clay loam, loam.	CL, SC	A-4, A-6	0	98-100	98-100	90-100	40-70	26-37	8-16
	56-62	Weathered bedrock.	---	---	---	---	---	---	---	---	---
7------------------- Dennis	0-13	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	100	100	96-100	65-97	20-37	1-15
	13-23	Silty clay loam, clay loam.	CL	A-6, A-7	0	98-100	98-100	94-100	75-98	33-48	13-25
	23-72	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	98-100	98-100	94-100	75-98	37-65	15-35

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
8------------------ Dougherty	0-34	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
	34-48	Fine sandy loam, sandy clay loam.	ML, SM, CL, SC	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
	48-80	Fine sandy loam, sandy clay loam.	SM, ML, CL, SC	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
9*: Eram---------------	0-11	Clay loam--------	ML, CL	A-6, A-7	0	85-100	85-100	85-100	75-95	33-48	12-25
	11-30	Clay, silty clay, clay loam.	ML, CL, CH, MH	A-7, A-6	0	95-100	95-100	90-100	85-98	37-65	15-35
	30-36	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Coweta-------------	0-8	Loam-------------	ML, CL, SM, SC	A-4	0-30	70-100	70-100	60-90	36-85	<31	NP-10
	8-16	Fine sandy loam, loam, clay loam.	ML, CL, SM, SC	A-2, A-4, A-6	0-25	55-75	55-75	45-70	30-65	<31	NP-12
	16-20	Weathered bedrock.	---	---	---	---	---	---	---	---	---
10*: Eufaula-----------	0-72	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
Dougherty---------	0-22	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
	22-40	Fine sandy loam, sandy clay loam.	ML, SM, CL, SC	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
	40-72	Fine sandy loam, sandy clay loam.	SM, ML, CL, SC	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
11*: Eufaula-----------	0-80	Fine sand--------	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
Dougherty---------	0-28	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
	28-44	Fine sandy loam, sandy clay loam.	ML, SM, CL, SC	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
	44-64	Fine sandy loam, sandy clay loam.	SM, ML, CL, SC	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
12------------------ Gaddy	0-8	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
	8-60	Loamy fine sand, fine sand.	SM	A-2	0	100	98-100	90-100	15-35	---	NP
13------------------ Gowton	0-28	Loam-------------	CL	A-4, A-6	0	100	100	96-100	65-90	25-40	8-24
	28-80	Loam, clay loam	CL	A-4, A-6	0	100	100	96-100	65-90	25-40	8-24
14*----------------- Gowton	0-10	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	100	98-100	94-100	36-60	<26	NP-7
	10-72	Loam, clay loam	CL	A-4, A-6	0	100	100	96-100	65-90	25-40	8-24
15------------------ Gracemont	0-10	Fine sandy loam	ML, CL, SM, SC	A-4, A-6	0	100	98-100	94-100	36-90	<40	NP-18
	10-80	Fine sandy loam, loam, clay loam.	ML, CL, SM, SC	A-4, A-6	0	100	98-100	94-100	36-90	<40	NP-18

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
16------------------ Gracemore	0-9	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
	9-60	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
17*:											
Grainola-----------	0-5	Silty clay loam	CL, SC, GC	A-6, A-7	0-55	40-95	40-95	40-95	36-90	37-50	15-25
	5-12	Silty clay, silty clay loam, clay.	CL, CH	A-7	0-15	75-100	75-100	75-98	70-98	41-70	20-40
	12-30	Silty clay, silty clay loam, clay.	CL, CH, SC, GC	A-2, A-7	0	20-90	20-90	20-85	18-85	41-70	20-40
	30-34	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Aydelotte----------	0-3	Clay loam--------	CL	A-6, A-7	0	100	100	96-100	80-90	33-50	12-26
	3-60	Clay, silty clay, clay loam.	CH, MH, CL, ML	A-7, A-6	0	100	98-100	96-100	75-99	37-70	15-38
18*:											
Grainola-----------	0-4	Clay loam--------	CL, SC, GC	A-6, A-7	0-55	40-95	40-95	40-95	36-90	37-50	15-25
	4-24	Silty clay, silty clay loam, clay.	CL, CH	A-7	0-15	75-100	75-100	75-98	70-98	41-70	20-40
	24-36	Silty clay, silty clay loam, clay.	CL, CH, SC, GC	A-2, A-7	0	20-90	20-90	20-85	18-85	41-70	20-40
	36-50	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Lucien-------------	0-4	Loam-------------	SM, SC, ML, CL	A-2, A-4	0-20	95-100	90-100	85-100	30-97	<31	NP-10
	4-12	Loam, fine sandy loam, silt loam.	SM, SC, ML, CL	A-2, A-4	0-5	90-100	85-100	80-100	30-97	<31	NP-10
	12-14	Weathered bedrock.	---	---	---	---	---	---	---	---	---
19------------------ Harjo	0-9	Clay-------------	CH, CL	A-7	0	98-100	98-100	90-100	75-99	45-60	22-35
	9-60	Stratified clay to clay loam.	CH, CL	A-7	0	98-100	98-100	90-100	75-99	45-65	22-38
	60-80	Stratified clay to very fine sandy loam.	CH, CL, ML	A-7, A6, A4	0	98-100	98-100	85-100	51-99	<65	NP-38
20------------------ Keokuk	0-60	Silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4	0	100	100	94-100	51-97	<30	NP-10
21------------------ Konawa	0-14	Fine sandy loam	CL, ML, SM, SM-SC	A-4	0	98-100	98-100	90-100	40-60	<26	NP-7
	14-36	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	98-100	98-100	85-100	40-60	26-40	8-18
	36-60	Fine sandy loam, sandy clay loam, loamy fine sand.	SM, SC, CL, ML	A-4, A-6, A-2	0	98-100	98-100	85-100	15-60	<34	NP-14

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
22----------------- Konawa	0-16	Fine sandy loam	CL, ML, SM, SM-SC	A-4	0	98-100	98-100	90-100	40-60	<26	NP-7
	16-50	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	98-100	98-100	85-100	40-60	26-40	8-18
	50-60	Fine sandy loam, sandy clay loam, loamy fine sand.	SM, SC, CL, ML	A-4, A-6, A-2	0	98-100	98-100	85-100	15-60	<34	NP-14
23----------------- Konawa	0-7	Fine sandy loam	CL, ML, SM, SM-SC	A-4	0	98-100	98-100	90-100	40-60	<26	NP-7
	7-45	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	98-100	98-100	85-100	40-60	26-40	8-18
	45-72	Fine sandy loam, sandy clay loam, loamy fine sand.	SM, SC, CL, ML	A-4, A-6, A-2	0	98-100	98-100	85-100	15-60	<34	NP-14
24----------------- Konawa	0-6	Fine sandy loam	CL, ML, SM, SM-SC	A-4	0	98-100	98-100	90-100	40-60	<26	NP-7
	6-40	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	98-100	98-100	85-100	40-60	26-40	8-18
	40-60	Fine sandy loam, sandy clay loam, loamy fine sand.	SM, SC, CL, ML	A-4, A-6, A-2	0	98-100	98-100	85-100	15-60	<34	NP-14
25----------------- Madill	0-10	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	98-100	94-100	36-85	<30	NP-10
	10-42	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	98-100	94-100	36-85	<30	NP-10
	42-60	Fine sandy loam, loam, loamy fine sand.	SM, SC, ML, CL	A-2, A-4	0	100	98-100	90-100	15-85	<30	NP-10
26*: Newtonia-----------	0-10	Silt loam--------	CL, ML	A-4, A-6	0	100	100	96-100	65-97	30-37	9-14
	10-16	Silt loam, silty clay loam.	CL, ML	A-4, A-6	0	100	100	96-100	80-98	30-40	8-19
	16-40	Silty clay loam	CL	A-6, A-7	0	100	100	98-100	90-98	33-42	12-19
	40-52	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	100	96-100	90-98	37-60	15-34
	52-61	Sandy clay loam.	CL, SC	A-6, A-4	0	100	100	90-100	36-65	25-37	7-16
	61-70	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Catoosa------------	0-14	Silt loam--------	ML, CL	A-4, A-6	0	100	100	96-100	65-97	30-37	9-13
	14-22	Silt loam, loam, clay loam.	ML, CL	A-4, A-6, A-7	0	100	100	96-100	65-98	30-43	9-20
	22-32	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	96-100	80-98	33-43	12-20
	32-34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
27*: Niotaze------------	0-10	Stony fine sandy loam.	SM, GM, ML, GC	A-2-4, A-4	25-60	55-100	50-100	40-95	30-95	<30	NP-10
	10-32	Silty clay, silty clay loam, clay.	CH, CL	A-7-6, A-6	0	95-100	95-100	90-100	90-100	35-65	15-40
	32-45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
27*: Darnell	0-4	Stony fine sandy loam.	SM, SC, ML, CL	A-4	5-25	90-100	90-100	85-100	36-60	<30	NP-10
	4-12	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0-8	70-100	70-100	60-100	36-60	<30	NP-10
	12-15	Weathered bedrock.	---	---	---	---	---	---	---	---	---
28*: Niotaze	0-10	Fine sandy loam	SM, GM, ML, GC	A-2-4, A-4	0-25	55-100	50-100	40-95	30-95	<30	NP-10
	10-32	Silty clay, silty clay loam, clay.	CH, CL	A-7-6, A-6	0	95-100	95-100	90-100	90-100	35-65	15-40
	32-36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Wewoka	0-5	Gravelly sandy loam.	SM, GM	A-2, A-4	0-10	40-85	40-85	30-75	15-50	<25	NP-4
	5-17	Gravelly loamy sand, very gravelly loamy sand.	SM, GM, SP-SM, GP-GM	A-2	0-10	15-70	15-70	10-60	5-25	<25	NP-4
	17-22	Very gravelly loamy sand.	GM, GP-GM	A-2	0-10	10-35	10-35	5-30	5-15	<25	NP-4
	22-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
29*. Oil-waste land											
30 Okemah	0-15	Silt loam	CL, ML	A-4, A-6, A-7	0	98-100	98-100	96-100	80-98	20-47	1-23
	15-60	Silty clay, clay, silty clay loam.	CL, CH, MH, ML	A-7	0	98-100	98-100	96-100	80-99	45-70	19-44
	60-80	Silty clay, clay, silty clay loam.	CL, CH, MH, ML	A-7	0	98-100	98-100	96-100	90-99	48-65	21-38
31 Okemah	0-18	Silt loam	CL, ML	A-4, A-6, A-7	0	98-100	98-100	96-100	80-98	20-47	1-23
	18-50	Silty clay, clay, silty clay loam.	CL, CH, MH, ML	A-7	0	98-100	98-100	96-100	80-99	45-70	19-44
	50-72	Silty clay, clay, silty clay loam.	CL, CH, MH, ML	A-7	0	98-100	98-100	96-100	90-99	48-65	21-38
32*: Okemah	0-16	Silt loam	CL, ML	A-4, A-6, A-7	0	98-100	98-100	96-100	80-98	20-47	1-23
	16-50	Silty clay, clay, silty clay loam.	CL, CH, MH, ML	A-7	0	98-100	98-100	96-100	80-99	45-70	19-44
	50-80	Silty clay, clay, silty clay loam.	CL, CH, MH, ML	A-7	0	98-100	98-100	96-100	90-99	48-65	21-38
Carytown	0-6	Silt loam	CL-ML, CL	A-4, A-6	0	100	95-100	95-100	80-95	20-30	5-15
	6-50	Clay	CH	A-7	0	100	95-100	90-100	90-100	51-70	30-45
	50-72	Silty clay loam, silty clay.	CH	A-7	0	100	95-100	90-100	85-100	51-65	30-40

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag-ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
33* Pits											
34----------------- Prue	0-18	Loam------------	CL, ML, CL-ML	A-4	0	100	100	96-100	65-85	22-31	3-10
	18-24	Loam, clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	100	90-100	36-85	25-35	7-15
	24-36	Sandy clay loam, clay loam.	CL, SC	A-4, A-6	0	95-100	95-100	90-100	36-85	25-35	7-15
	36-72	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0	70-100	70-100	65-100	65-99	35-60	15-35
35----------------- Prue	0-20	Loam------------	CL, ML, CL-ML	A-4	0	100	100	96-100	65-85	22-31	3-10
	20-30	Loam, clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	100	90-100	36-85	25-35	7-15
	30-44	Sandy clay loam, clay loam.	CL, SC	A-4, A-6	0	95-100	95-100	90-100	36-85	25-35	7-15
	44-72	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0	70-100	70-100	65-100	65-99	35-60	15-35
36----------------- Roebuck	0-60	Clay------------	CL, CH	A-6, A-7	0	100	100	96-100	90-99	37-70	15-40
37----------------- Seminole	0-12	Loam------------	ML, CL, CL-ML	A-4	0	100	100	96-100	65-97	22-31	2-10
	12-16	Loam, clay loam, silt loam.	CL	A-6, A-7, A-4	0	100	100	96-100	60-98	30-43	8-20
	16-72	Clay, silty clay, clay loam.	CL, CH	A-7, A-6	0	100	100	96-100	70-98	37-60	16-34
38----------------- Seminole	0-5	Loam------------	ML, CL, CL-ML	A-4	0	100	100	96-100	65-97	22-31	2-10
	5-16	Loam, clay loam, silt loam.	CL	A-6, A-7, A-4	0	100	100	96-100	60-98	30-43	8-20
	16-60	Clay, silty clay, clay loam.	CL, CH	A-7, A-6	0	100	100	96-100	70-98	37-60	16-34
39*: Seminole-----------	0-7	Loam------------	ML, CL, CL-ML	A-4	0	100	100	96-100	65-97	22-31	2-10
	7-17	Loam, clay loam, silt loam.	CL	A-6, A-7, A-4	0	100	100	96-100	60-98	30-43	8-20
	17-60	Clay, silty clay, clay loam.	CL, CH	A-7, A-6	0	100	100	96-100	70-98	37-60	16-34
Chickasha---------	0-8	Loam------------	ML, CL-ML, SM, SM-SC	A-4	0	100	98-100	94-100	36-70	<26	NP-6
	8-17	Sandy clay loam, clay loam, loam.	CL, SC	A-4, A-6	0	100	100	90-100	40-70	28-39	9-18
	17-58	Sandy clay loam, loam.	CL, SC	A-4, A-6	0	98-100	98-100	90-100	40-70	26-37	8-16
	58-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
39*:											
Prue	0-7	Loam	CL, ML, CL-ML	A-4	0	100	100	96-100	65-85	22-31	3-10
	7-21	Loam, clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	100	90-100	36-85	25-35	7-15
	21-33	Sandy clay loam, clay loam.	CL, SC	A-4, A-6	0	95-100	95-100	90-100	36-85	25-35	7-15
	33-60	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0	70-100	70-100	65-100	65-99	35-60	15-35
40*:											
Seminole	0-5	Loam	ML, CL, CL-ML	A-4	0	100	100	96-100	65-97	22-31	2-10
	5-8	Loam, clay loam, silt loam.	CL	A-6, A-7, A-4	0	100	100	96-100	60-98	30-43	8-20
	8-60	Clay, silty clay, clay loam.	CL, CH	A-7, A-6	0	100	100	96-100	70-98	37-60	16-34
Gowton	0-40	Loam	CL	A-4, A-6	0	100	100	96-100	65-90	25-40	8-24
	40-60	Loam, clay loam	CL	A-4, A-6	0	100	100	96-100	65-90	25-40	8-24
41*:											
Shidler	0-18	Silt loam	CL, ML	A-4, A-6	0	90-100	90-100	90-100	75-98	30-37	8-13
	18-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
42 Stephenville	0-14	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	14-34	Fine sandy loam, sandy clay loam.	SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	25-37	7-16
	34-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
43 Stephenville	0-7	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	7-36	Fine sandy loam, sandy clay loam.	SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	25-37	7-16
	36-38	Weathered bedrock.	---	---	---	---	---	---	---	---	---
44*:											
Stephenville	0-12	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	12-26	Fine sandy loam, sandy clay loam.	SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	25-37	7-16
	26-30	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Darnell	0-7	Fine sandy loam	SM, SC, ML, CL	A-4	0-5	90-100	90-100	85-100	36-60	<30	NP-10
	7-18	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0-8	70-100	70-100	60-100	36-60	<30	NP-10
	18-20	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
45*: Stephenville-------	0-6	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	6-38	Fine sandy loam, sandy clay loam.	SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	25-37	7-16
	38-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Darnell------------	0-5	Fine sandy loam	SM, SC, ML, CL	A-4	0-5	90-100	90-100	85-100	36-60	<30	NP-10
	5-13	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0-8	70-100	70-100	60-100	36-60	<30	NP-10
	13-14	Weathered bedrock.	---	---	---	---	---	---	---	---	---
46------------------ Teller	0-22	Loam-------------	SM, SC, ML, CL	A-4	0	100	100	94-100	36-85	<30	NP-10
	22-48	Sandy clay loam, clay loam.	SC, CL	A-6, A-4	0	100	100	90-100	45-85	24-40	7-18
	48-60	Fine sandy loam, very fine sandy loam, loam.	SM, SC, ML, CL	A-4, A-6	0	100	100	94-100	45-85	20-34	3-13
47------------------ Teller	0-20	Loam-------------	SM, SC, ML, CL	A-4	0	100	100	94-100	36-85	<30	NP-10
	20-48	Sandy clay loam, clay loam.	SC, CL	A-6, A-4	0	100	100	90-100	45-85	24-40	7-18
	48-65	Fine sandy loam, very fine sandy loam, loam.	SM, SC, ML, CL	A-4, A-6	0	100	100	94-100	45-85	20-34	3-13
48------------------ Tullahassee	0-8	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	98-100	90-100	36-85	<30	NP-10
	8-60	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	98-100	90-100	36-85	<30	NP-10
49------------------ Waurika	0-11	Silt loam--------	CL, ML	A-4, A-6	0	100	100	96-100	80-95	22-37	3-14
	11-30	Clay, silty clay	CL, CH, MH	A-7	0	95-100	95-100	90-100	80-98	41-66	20-40
	30-44	Silty clay loam, clay loam, clay.	CL, CH, ML, MH	A-6, A-7	0	90-100	90-100	85-100	80-98	38-55	16-30
	44-60	Clay loam, silty clay loam.	CL, ML	A-6, A-7	0	90-100	90-100	80-100	70-98	33-43	12-20
50------------------ Wynona	0-6	Silt loam--------	CL, ML	A-4, A-6	0	100	100	96-100	80-97	30-37	8-13
	6-32	Silty clay loam	CL	A-6, A-7	0	100	100	98-100	90-98	33-42	12-19
	32-60	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	98-100	90-98	33-55	12-30
51------------------ Yahola	0-7	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
	7-44	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
	44-60	Fine sandy loam, loam, loamy fine sand.	SM, SC, ML, CL	A-4, A-2	0	100	95-100	90-100	15-85	<30	NP-10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than. "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" are for the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
1----------------- Asher	0-22	---	---	0.06-0.2	0.18-0.22	6.1-8.4	<2	Moderate	0.37	5	---	---
	22-60	---	---	0.6-2.0	0.13-0.24	7.4-8.4	<2	Low--------	0.43			
2----------------- Aydelotte	0-5	---	---	0.6-2.0	0.15-0.20	6.1-7.3	<2	Low--------	0.49	4	---	---
	5-62	---	---	<0.06	0.12-0.18	6.1-8.4	<2	High-------	0.43			
3----------------- Bates	0-20	---	---	0.6-2.0	0.20-0.22	5.1-6.5	<2	Low--------	0.28	4	5	---
	20-38	---	---	0.6-2.0	0.15-0.19	5.1-6.5	<2	Moderate	0.28			
	38-42	---	---	---	---	---	---	-----------	---			
4----------------- Bates	0-21	---	---	0.6-2.0	0.20-0.22	5.1-6.5	<2	Low--------	0.28	4	5	---
	21-32	---	---	0.6-2.0	0.15-0.19	5.1-6.5	<2	Moderate	0.28			
	32-40	---	---	---	---	---	---	-----------	---			
5*:												
Bates------------	0-9	---	---	0.6-2.0	0.15-0.17	5.1-6.5	<2	Low--------	0.20	4	3	---
	9-25	---	---	0.6-2.0	0.15-0.19	5.1-6.5	<2	Moderate	0.28			
	25-30	---	---	---	---	---	---	-----------	---			
Coweta-----------	0-9	---	---	2.0-6.0	0.09-0.16	5.1-6.5	<2	Low--------	0.32	2	---	---
	9-14	---	---	0.6-2.0	0.09-0.18	5.1-6.5	<2	Low--------	0.24			
	14-20	---	---	---	---	---	---	-----------	---			
6----------------- Chickasha	0-10	---	---	2.0-6.0	0.13-0.17	5.6-7.3	<2	Low--------	0.37	4	---	---
	10-32	---	---	0.6-2.0	0.14-0.18	5.6-7.3	<2	Low--------	0.37			
	32-56	---	---	0.6-2.0	0.13-0.17	5.6-8.4	<2	Low--------	0.37			
	56-62	---	---	---	---	---	---	-----------	---			
7----------------- Dennis	0-13	---	---	0.6-2.0	0.15-0.20	5.1-6.0	<2	Low--------	0.43	5	---	---
	13-23	---	---	0.2-0.6	0.15-0.20	4.5-6.0	<2	Moderate	0.37			
	23-72	---	---	0.06-0.2	0.15-0.20	5.1-8.4	<2	High-------	0.37			
8----------------- Dougherty	0-34	---	---	2.0-6.0	0.07-0.11	5.1-6.5	<2	Low--------	0.20	5	2	---
	34-48	---	---	0.6-2.0	0.11-0.17	5.1-6.5	<2	Low--------	0.32			
	48-80	---	---	0.6-2.0	0.11-0.17	5.1-7.3	<2	Low--------	0.32			
9*:												
Eram-------------	0-11	---	---	0.2-0.6	0.15-0.19	5.6-6.5	<2	Moderate	0.43	3	---	---
	11-30	---	---	0.06-0.2	0.14-0.18	5.1-7.3	<2	High-------	0.37			
	30-36	---	---	---	---	---	---	-----------	---			
Coweta-----------	0-8	---	---	2.0-6.0	0.09-0.16	5.1-6.5	<2	Low--------	0.32	2	---	---
	8-16	---	---	0.6-2.0	0.09-0.18	5.1-6.5	<2	Low--------	0.24			
	16-20	---	---	---	---	---	---	-----------	---			
10*:												
Eufaula----------	0-72	---	---	6.0-20.0	0.05-0.11	5.1-7.3	<2	Low--------	0.17	5	1	---
Dougherty--------	0-22	---	---	2.0-6.0	0.07-0.11	5.1-6.5	<2	Low--------	0.20	5	2	---
	22-40	---	---	0.6-2.0	0.11-0.17	5.1-6.5	<2	Low--------	0.32			
	40-72	---	---	0.6-2.0	0.11-0.17	5.1-7.3	<2	Low--------	0.32			
11*:												
Eufaula----------	0-80	---	---	6.0-20.0	0.05-0.11	5.1-7.3	<2	Low--------	0.17	5	1	---
Dougherty--------	0-28	---	---	2.0-6.0	0.07-0.11	5.1-6.5	<2	Low--------	0.20	5	2	---
	28-44	---	---	0.6-2.0	0.11-0.17	5.1-6.5	<2	Low--------	0.32			
	44-64	---	---	0.6-2.0	0.11-0.17	5.1-7.3	<2	Low--------	0.32			
12----------------- Gaddy	0-8	---	---	6.0-20	0.07-0.11	7.4-8.4	<2	Low--------	0.17	5	2	---
	8-60	---	---	6.0-20	0.06-0.10	7.9-8.4	<2	Low--------	0.17			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
13---------------- Gowton	0-28	---	---	0.6-2.0	0.15-0.20	5.6-7.8	<2	Low--------	0.24	5	---	---
	28-80	---	---	0.6-2.0	0.15-0.20	5.6-8.4	<2	Low--------	0.32			
14*--------------- Gowton	0-10	---	---	0.6-2.0	0.11-0.15	5.6-7.8	<2	Low--------	0.24	5	---	---
	10-72	---	---	0.6-2.0	0.15-0.20	5.6-8.4	<2	Low--------	0.32			
15---------------- Gracemont	0-10	---	---	0.6-6.0	0.11-0.20	6.6-8.4	0-2	Low--------	0.28	5	---	---
	10-80	---	---	0.6-6.0	0.11-0.20	7.9-8.4	0-2	Low--------	0.32			
16---------------- Gracemore	0-9	---	---	2.0-6.0	0.05-0.11	7.9-8.4	<2	Low--------	0.17	5	8	---
	9-60	---	---	2.0-6.0	0.05-0.11	7.9-8.4	<2	Low--------	0.17			
17*:												
Grainola---------	0-5	---	---	0.2-0.6	0.10-0.20	7.4-8.4	<2	Moderate	0.37	3	7	---
	5-12	---	---	0.06-0.2	0.10-0.20	7.4-8.4	<2	High-------	0.32			
	12-30	---	---	0.06-0.2	0.05-0.18	7.4-8.4	<2	High-------	0.32			
	30-34	---	---	---	---	---	---	-----------	---			
Aydelotte--------	0-3	---	---	0.2-0.6	0.15-0.20	6.1-7.3	<2	Moderate	0.43	4	---	---
	3-60	---	---	<0.06	0.12-0.18	6.1-8.4	<2	High-------	0.43			
18*:												
Grainola---------	0-4	---	---	0.2-0.6	0.10-0.20	7.4-8.4	<2	Moderate	0.37	3	7	---
	4-24	---	---	0.06-0.2	0.10-0.20	7.4-8.4	<2	High-------	0.32			
	24-36	---	---	0.06-0.2	0.05-0.18	7.4-8.4	<2	High-------	0.32			
	36-50	---	---	---	---	---	---	-----------	---			
Lucien-----------	0-4	---	---	2.0-6.0	0.10-0.24	5.6-7.3	<2	Low--------	0.32	2	---	---
	4-12	---	---	2.0-6.0	0.10-0.24	5.6-7.3	<2	Low--------	0.32			
	12-14	---	---	---	---	---	---	-----------	---			
19---------------- Harjo	0-9	---	---	<0.06	0.14-0.18	7.4-8.4	<2	High-------	0.43	5	---	---
	9-60	---	---	<0.06	0.14-0.18	7.9-8.4	<2	High-------	0.43			
	60-80	---	---	0.06-2.0	0.10-0.18	7.9-8.4	<2	High-------	0.49			
20---------------- Keokuk	0-60	---	---	0.6-2.0	0.15-0.20	6.1-8.4	<2	Low--------	0.37	5	---	---
21---------------- Konawa	0-14	---	---	2.0-6.0	0.11-0.15	5.6-6.5	<2	Low--------	0.24	5	---	---
	14-36	---	---	0.6-2.0	0.12-0.16	5.1-6.0	<2	Low--------	0.32			
	36-60	---	---	2.0-6.0	0.11-0.15	5.1-7.3	<2	Low--------	0.24			
22---------------- Konawa	0-16	---	---	2.0-6.0	0.11-0.15	5.6-6.5	<2	Low--------	0.24	5	---	---
	16-50	---	---	0.6-2.0	0.12-0.16	5.1-6.0	<2	Low--------	0.32			
	50-60	---	---	2.0-6.0	0.11-0.15	5.1-7.3	<2	Low--------	0.24			
23---------------- Konawa	0-7	---	---	2.0-6.0	0.11-0.15	5.6-6.5	<2	Low--------	0.24	5	---	---
	7-45	---	---	0.6-2.0	0.12-0.16	5.1-6.0	<2	Low--------	0.32			
	45-72	---	---	2.0-6.0	0.11-0.15	5.1-7.3	<2	Low--------	0.24			
24---------------- Konawa	0-6	---	---	2.0-6.0	0.11-0.15	5.6-6.5	<2	Low--------	0.24	5	---	---
	6-40	---	---	0.6-2.0	0.12-0.16	5.1-6.0	<2	Low--------	0.32			
	40-60	---	---	2.0-6.0	0.11-0.15	5.1-7.3	<2	Low--------	0.24			
25---------------- Madill	0-10	---	---	2.0-6.0	0.11-0.16	5.6-7.3	<2	Low--------	0.32	5	---	---
	10-42	---	---	2.0-6.0	0.11-0.16	5.6-7.3	<2	Low--------	0.32			
	42-60	---	---	2.0-6.0	0.07-0.16	5.6-8.4	<2	Low--------	0.32			
26*:												
Newtonia---------	0-10	---	---	0.6-2.0	0.15-0.24	5.6-6.5	<2	Low--------	0.37	5	---	---
	10-16	---	---	0.6-2.0	0.16-0.22	5.1-6.5	<2	Moderate	0.37			
	16-40	---	---	0.6-2.0	0.18-0.22	5.1-6.0	<2	Moderate	0.32			
	40-52	---	---	0.6-2.0	0.12-0.20	5.1-6.0	<2	High-------	0.32			
	52-61	---	---	0.6-2.0	0.12-0.17	5.1-7.3	<2	Low--------	0.32			
	61-70	---	---	---	---	---	---	-----------	---		---	---
Catoosa----------	0-14	---	---	0.6-2.0	0.15-0.24	5.6-6.5	<2	Low--------	0.37	2	---	---
	14-22	---	---	0.6-2.0	0.15-0.24	5.6-6.5	<2	Moderate	0.37			
	22-32	---	---	0.6-2.0	0.15-0.22	5.1-7.3	<2	Moderate	0.32			
	32-34	---	---	---	---	---	---	-----------	---			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
27*:												
Niotaze----------	0-10	---	---	0.6-6.0	0.10-0.16	5.1-6.0	<2	Low--------	0.15	3	8	---
	10-32	---	---	0.06-0.2	0.10-0.18	4.5-7.3	<2	High-------	0.32			
	32-45	---	---	---	---	---	---	-----------	---			
Darnell----------	0-4	---	---	2.0-6.0	0.12-0.16	5.1-7.3	<2	Low--------	0.15	2	---	---
	4-12	---	---	2.0-6.0	0.12-0.16	5.1-7.3	<2	Low--------	0.32			
	12-15	---	---	---	---	---	---	-----------	---			
28*:												
Niotaze----------	0-10	---	---	0.6-6.0	0.16-0.24	5.1-6.0	<2	Low--------	0.20	3	3	---
	10-32	---	---	0.06-0.2	0.10-0.18	4.5-7.3	<2	High-------	0.32			
	32-36	---	---	---	---	---	---	-----------	---			
Wewoka-----------	0-5	---	---	2.0-6.0	0.08-0.12	4.5-7.3	<2	Low--------	0.17	3	---	---
	5-17	---	---	2.0-6.0	0.05-0.12	4.5-7.3	<2	Low--------	0.15			
	17-22	---	---	2.0-6.0	0.05-0.10	4.5-7.3	<2	Low--------	0.15			
	22-40	---	---	---	---	---	---	-----------	---			
29*. Oil-waste land												
30---------------- Okemah	0-15	---	---	0.2-2.0	0.16-0.20	5.6-7.3	<2	Low--------	0.43	5	---	---
	15-60	---	---	0.06-0.2	0.15-0.19	5.6-7.8	<2	High-------	0.43			
	60-80	---	---	0.06-0.2	0.15-0.19	6.6-8.4	<2	High-------	0.37			
31---------------- Okemah	0-18	---	---	0.2-2.0	0.16-0.20	5.6-7.3	<2	Low--------	0.43	5	---	---
	18-50	---	---	0.06-0.2	0.15-0.19	5.6-7.8	<2	High-------	0.43			
	50-72	---	---	0.06-0.2	0.15-0.19	6.6-8.4	<2	High-------	0.37			
32*:												
Okemah-----------	0-16	---	---	0.2-2.0	0.16-0.20	5.6-7.3	<2	Low--------	0.43	5	---	---
	16-50	---	---	0.06-0.2	0.15-0.19	5.6-7.8	<2	High-------	0.43			
	50-80	---	---	0.06-0.2	0.15-0.19	6.6-8.4	<2	High-------	0.37			
Carytown---------	0-6	---	---	0.6-2.0	0.19-0.24	5.1-7.3	<2	Low--------	---	---	6	---
	6-50	---	---	<0.06	0.08-0.11	5.6-8.4	<2	High-------	---			
	50-72	---	---	0.06-0.2	0.10-0.13	6.6-9.0	<2	High-------	---			
33*. Pits												
34---------------- Prue	0-18	---	---	0.6-2.0	0.15-0.20	5.1-6.5	<2	Low--------	0.37	5	---	---
	18-24	---	---	0.6-2.0	0.12-0.20	5.1-6.5	<2	Low--------	0.32			
	24-36	---	---	0.6-2.0	0.12-0.20	5.1-6.5	<2	Low--------	---			
	36-72	---	---	0.2-0.6	0.14-0.20	5.1-8.4	<2	High-------	---			
35---------------- Prue	0-20	---	---	0.6-2.0	0.15-0.20	5.1-6.5	<2	Low--------	0.37	5	---	---
	20-30	---	---	0.6-2.0	0.12-0.20	5.1-6.5	<2	Low--------	0.32			
	30-44	---	---	0.6-2.0	0.12-0.20	5.1-6.5	<2	Low--------	---			
	44-72	---	---	0.2-0.6	0.14-0.20	5.1-8.4	<2	High-------	---			
36---------------- Roebuck	0-60	---	---	<0.06	0.12-0.20	6.1-8.4	<2	High-------	0.37	5	---	---
37---------------- Seminole	0-12	---	---	0.6-2.0	0.15-0.20	5.6-7.3	<2	Low--------	0.43	1	---	---
	12-16	---	---	0.2-0.6	0.15-0.20	5.6-7.3	<4	Moderate	0.37			
	16-72	---	---	0.06-0.2	0.10-0.15	5.6-8.4	<8	High-------	0.32			
38---------------- Seminole	0-5	---	---	0.6-2.0	0.15-0.20	5.6-7.3	<2	Low--------	0.43	1	---	---
	5-16	---	---	0.2-0.6	0.15-0.20	5.6-7.3	<4	Moderate	0.37			
	16-60	---	---	0.06-0.2	0.10-0.15	5.6-8.4	<8	High-------	0.32			
39*:												
Seminole---------	0-7	---	---	0.6-2.0	0.15-0.20	5.6-7.3	<2	Low--------	0.43	1	---	---
	7-17	---	---	0.2-0.6	0.15-0.20	5.6-7.3	<4	Moderate	0.37			
	17-60	---	---	0.06-0.2	0.10-0.15	5.6-8.4	<8	High-------	0.32			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
39*:												
Chickasha--------	0-8	---	---	2.0-6.0	0.13-0.17	5.6-7.3	<2	Low--------	0.37	4	---	---
	8-17	---	---	0.6-2.0	0.14-0.18	5.6-7.3	<2	Low--------	0.37			
	17-58	---	---	0.6-2.0	0.13-0.17	5.6-8.4	<2	Low--------	0.37			
	58-60	---	---	---	---	---	---	-----------	---			
Prue-------------	0-7	---	---	0.6-2.0	0.15-0.20	5.1-6.5	<2	Low--------	0.37	5	---	---
	7-21	---	---	0.6-2.0	0.12-0.20	5.1-6.5	<2	Low--------	0.32			
	21-33	---	---	0.6-2.0	0.12-0.20	5.1-6.5	<2	Low--------	---			
	33-60	---	---	0.2-0.6	0.14-0.20	5.1-8.4	<2	High-------	---			
40*:												
Seminole---------	0-5	---	---	0.6-2.0	0.15-0.20	5.6-7.3	<2	Low--------	0.43	1	---	---
	5-8	---	---	0.2-0.6	0.15-0.20	5.6-7.3	<4	Moderate	0.37			
	8-60	---	---	0.06-0.2	0.10-0.15	5.6-8.4	<8	High-------	0.32			
Gowton-----------	0-40	---	---	0.6-2.0	0.15-0.20	5.6-7.8	<2	Low--------	0.24	5	---	---
	40-60	---	---	0.6-2.0	0.15-0.20	5.6-8.4	<2	Low--------	0.32			
41*:												
Shidler----------	0-18	---	---	0.6-2.0	0.16-0.24	5.6-8.4	<2	Low--------	0.37	1	---	---
	18-20	---	---	---	---	---	---	-----------	---			
Rock outcrop.												
42--------------- Stephenville	0-14	---	---	2.0-6.0	0.11-0.15	5.1-7.3	<2	Low--------	0.24	3	---	---
	14-34	---	---	0.6-2.0	0.11-0.17	5.1-6.5	<2	Low--------	0.32			
	34-40	---	---	---	---	---	---	-----------	---			
43--------------- Stephenville	0-7	---	---	2.0-6.0	0.11-0.15	5.1-7.3	<2	Low--------	0.24	3	---	---
	7-36	---	---	0.6-2.0	0.11-0.17	5.1-6.5	<2	Low--------	0.32			
	36-38	---	---	---	---	---	---	-----------	---			
44*:												
Stephenville-----	0-12	---	---	2.0-6.0	0.11-0.15	5.1-7.3	<2	Low--------	0.24	3	---	---
	12-26	---	---	0.6-2.0	0.11-0.17	5.1-6.5	<2	Low--------	0.32			
	26-30	---	---	---	---	---	---	-----------	---			
Darnell----------	0-7	---	---	2.0-6.0	0.12-0.16	5.1-7.3	<2	Low--------	0.20	2	---	---
	7-18	---	---	2.0-6.0	0.12-0.16	5.1-7.3	<2	Low--------	0.32			
	18-20	---	---	---	---	---	---	-----------	---			
45*:												
Stephenville-----	0-6	---	---	2.0-6.0	0.11-0.15	5.1-7.3	<2	Low--------	0.24	3	---	---
	6-38	---	---	0.6-2.0	0.11-0.17	5.1-6.5	<2	Low--------	0.32			
	38-40	---	---	---	---	---	---	-----------	---			
Darnell----------	0-5	---	---	2.0-6.0	0.12-0.16	5.1-7.3	<2	Low--------	0.20	2	---	---
	5-13	---	---	2.0-6.0	0.12-0.16	5.1-7.3	<2	Low--------	0.32			
	13-14	---	---	---	---	---	---	-----------	---			
46--------------- Teller	0-22	---	---	2.0-6.0	0.12-0.16	5.6-6.5	<2	Low--------	0.37	5	---	---
	22-48	---	---	0.6-2.0	0.14-0.18	5.6-6.5	<2	Low--------	0.32			
	48-60	---	---	2.0-6.0	0.13-0.17	5.6-7.3	<2	Low--------	0.32			
47--------------- Teller	0-20	---	---	2.0-6.0	0.12-0.16	5.6-6.5	<2	Low--------	0.37	5	---	---
	20-48	---	---	0.6-2.0	0.14-0.18	5.6-6.5	<2	Low--------	0.32			
	48-65	---	---	2.0-6.0	0.13-0.17	5.6-7.3	<2	Low--------	0.32			
48--------------- Tullahassee	0-8	---	---	2.0-6.0	0.12-0.16	5.6-6.5	<2	Low--------	0.32	5	---	---
	8-60	---	---	2.0-6.0	0.12-0.16	5.6-6.5	<2	Low--------	0.32			
49--------------- Waurika	0-11	---	---	0.6-2.0	0.16-0.20	5.6-7.3	<2	Low--------	0.49	5	---	---
	11-30	---	---	<0.06	0.13-0.17	6.6-8.4	<2	High-------	0.37			
	30-44	---	---	0.06-0.2	0.15-0.19	7.4-8.4	<2	Moderate	0.37			
	44-60	---	---	0.06-0.2	0.15-0.19	7.4-8.4	<2	Moderate	0.37			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
50---------------- Wynona	0-6	---	---	0.2-0.6	0.18-0.22	5.1-6.5	<2	Moderate	0.37	5	---	---
	6-32	---	---	0.2-0.6	0.18-0.22	5.1-6.5	<2	Moderate	0.37			
	32-60	---	---	0.06-0.2	0.14-0.20	5.1-6.0	<2	Moderate	0.37			
51---------------- Yahola	0-7	---	---	2.0-6.0	0.12-0.16	7.4-8.4	<2	Low--------	0.32	5	3	---
	7-44	---	---	2.0-6.0	0.12-0.16	7.9-8.4	<2	Low--------	0.32			
	44-60	---	---	2.0-6.0	0.07-0.16	7.9-8.4	<2	Low--------	0.32			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Depth	Hard-ness
					Ft			In		In	
1----------------- Asher	C	Rare---------	Very brief	Mar-Aug	>6.0	---	---	>60	---	---	---
2----------------- Aydelotte	D	None---------	---	---	>6.0	---	---	>60	---	---	---
3, 4-------------- Bates	B	None---------	---	---	>6.0	---	---	20-40	Rip-pable	---	---
5*:											
Bates-------------	B	None---------	---	---	>6.0	---	---	20-40	Rip-pable	---	---
Coweta------------	C	None---------	---	---	>6.0	---	---	10-20	Rip-pable	---	---
6----------------- Chickasha	B	None---------	---	---	>6.0	---	---	40-60	Rip-pable	---	---
7----------------- Dennis	C	None---------	---	---	2.0-3.0	Perched	Nov-May	>60	---	---	---
8----------------- Dougherty	A	None---------	---	---	>6.0	---	---	>60	---	---	---
9*:											
Eram--------------	C	None---------	---	---	2.0-3.0	Perched	Nov-May	20-40	Rip-pable	---	---
Coweta------------	C	None---------	---	---	>6.0	---	---	10-20	Rip-pable	---	---
10*, 11*:											
Eufaula-----------	A	None---------	---	---	>6.0	---	---	>60	---	---	---
Dougherty---------	A	None---------	---	---	>6.0	---	---	>60	---	---	---
12---------------- Gaddy	A	Occasional--	Very brief	Mar-Aug	>6.0	---	---	>60	---	---	---
13---------------- Gowton	B	Occasional--	Very brief	Mar-Aug	>6.0	---	---	>60	---	---	---
14*--------------- Gowton	B	Frequent----	Very brief	Mar-Aug	>6.0	---	---	>60	---	---	---
15---------------- Gracemont	B	Frequent----	Very brief	Mar-Aug	0.5-3.0	Apparent	Nov-May	>60	---	---	---
16---------------- Gracemore	C	Frequent----	Very brief	Mar-Aug	0.5-3.0	Apparent	Nov-May	>60	---	---	---
17*:											
Grainola----------	D	None---------	---	---	>6.0	---	---	20-40	Rip-pable	---	---
Aydelotte---------	D	None---------	---	---	>6.0	---	---	>60	---	---	---

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Depth	Hard-ness
					Ft			In		In	
18*:											
Grainola	D	None	---	---	>6.0	---	---	20-40	Rip-pable	---	---
Lucien	C	None	---	---	>6.0	---	---	10-20	Rip-pable	---	---
19 Harjo	D	Frequent	Very long	Oct-Jun	<1.0	Apparent	Oct-Jun	>60	---	---	---
20 Keokuk	B	Rare	Very brief	Mar-Aug	>6.0	---	---	>60	---	---	---
21, 22, 23, 24 Konawa	B	None	---	---	>6.0	---	---	>60	---	---	---
25 Madill	B	Occasional	Very brief	Mar-Aug	>6.0	---	---	>60	---	---	---
26*:											
Newtonia	B	None	---	---	>6.0	---	---	>60	---	---	---
Catoosa	B	None	---	---	>6.0	---	---	20-40	Hard	---	---
27*:											
Niotaze	C	None	---	---	1.0-2.0	Perched	Nov-May	20-40	Rip-pable	---	---
Darnell	C	None	---	---	>6.0	---	---	10-20	Rip-pable	---	---
28*:											
Niotaze	C	None	---	---	1.0-2.0	Perched	Nov-May	20-40	Rip-pable	---	---
Wewoka	C	None	---	---	>6.0	---	---	20-40	Rip-pable	---	---
29*. Oil-waste land											
30, 31 Okemah	C	None	---	---	2.0-3.0	Perched	Nov-May	>60	---	---	---
32*:											
Okemah	C	None	---	---	2.0-3.0	Perched	Nov-May	>60	---	---	---
Carytown	D	None	---	---	0-1.0	Perched	Nov-May	>60	---	---	---
33*. Pits											
34, 35 Prue	B	None	---	---	>6.0	---	---	>60	---	---	---
36 Roebuck	D	Occasional	Brief	Mar-Aug	>6.0	---	---	>60	---	---	---
37, 38 Seminole	C	None	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---
39*:											
Seminole	C	None	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---
Chickasha	B	None	---	---	>6.0	---	---	40-60	Rip-pable	---	---

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Depth	Hard-ness
					Ft			In		In	
39* Prue	B	None	---	---	>6.0	---	---	>60	---	---	---
40*: Seminole	C	None	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---
Gowton	B	Frequent	Very brief	Mar-Aug	>6.0	---	---	>60	---	---	---
41*: Shidler	D	None	---	---	>6.0	---	---	4-20	Hard	---	---
Rock outcrop.											
42, 43 Stephenville	B	None	---	---	>6.0	---	---	20-40	Rip-pable	---	---
44*, 45*: Stephenville	B	None	---	---	>6.0	---	---	20-40	Rip-pable	---	---
Darnell	C	None	---	---	>6.0	---	---	10-20	Rip-pable	---	---
46, 47 Teller	B	None	---	---	>6.0	---	---	>60	---	---	---
48 Tullahassee	C	Frequent	Very brief	Mar-Aug	2.0-3.0	Apparent	Nov-May	>60	---	---	---
49 Waurika	D	None	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---
50 Wynona	C	Occasional	Very brief	Mar-Aug	0-2.0	Perched	Nov-May	>60	---	---	---
51 Yahola	B	Occasional	Very brief	Mar-Aug	>6.0	---	---	>60	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING TEST DATA

[Tests performed by State of Oklahoma Department of Highways, Materials Division]

Soil name and location	Parent material	Depth from surface	Shrinkage limit	Shrinkage ratio	Volume change	Mechanical analysis: Percentage passing sieve-- No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	Percentage smaller than-- 0.05 mm	0.005 mm	0.002 mm	Liquid limit	Plasticity index
		In		Pct									
Aydelotte loam:													
About 1,500 feet west	Shale	0-5	14	1.81	14	100	98	60	47	22	17	27	
and 1,400 feet north		5-21	8	2.07	78	100	99	82	76	53	48	56	3
of SE corner sec. 15		21-40	8	2.07	70	100	99	80	74	51	47	54	3
T. 6 N., R. 5 E.		40-62	9	2.08	65	100	99	76	70	52	45	46	2
Eufaula fine sand:													
About 2,350 feet east	Sandy material	0-7	NP	NP	NP	100	91	25	23	8	7	--	N
and 100 feet south of		7-37	NP	NP	NP	100	91	19	15	7	6	--	N
NW corner sec. 3, T. 5 N., R. 6 E.		37-72	NP	NP	NP	100	89	14	11	7	6	--	N
Gowton loam:													
About 1,550 feet east	Alluvium	0-12	15	1.82	20	100	99	80	70	25	20	28	
and 650 feet north of		12-28	13	1.90	35	100	99	82	70	32	26	31	2
SW corner sec. 13, T.		28-42	11	1.96	32	100	100	80	70	33	27	31	1
9 N., R. 7 E.		42-60	12	1.95	28	100	99	72	63	31	27	27	1
		60-80	12	1.95	22	100	98	58	48	25	21	15	1
Gracemont fine sandy loam:													
About 1,200 feet south	Alluvium	0-10	NP	NP	NP	100	99	44	26	12	11	--	N
and 400 feet west of NE corner sec. 15, T. 7 N., R. 5 E.		10-85	NP	NP	NP	100	100	57	34	15	13	--	N
Harjo clay:													
About 1,500 feet south	Alluvium	0-9	10	2.01	74	100	100	98	96	63	52	53	3
and 500 feet west of		9-60	10	2.04	67	100	100	99	99	75	62	65	3
the NE corner sec. 15, T. 7 N., R. 5 E.		60-80	14	1.86	19	100	100	81	60	29	24	27	

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Asher	Fine-silty, mixed, thermic Fluventic Haplustolls
Aydelotte	Fine, mixed, thermic Udertic Paleustalfs
*Bates	Fine-loamy, siliceous, thermic Typic Argiudolls
*Carytown	Fine, mixed, thermic Albic Natraqualfs
*Catoosa	Fine-silty, mixed, thermic Typic Argiudolls
Chickasha	Fine-loamy, mixed, thermic Udic Argiustolls
*Coweta	Loamy, siliceous, thermic, shallow Typic Hapludolls
Darnell	Loamy, siliceous, thermic, shallow Udic Ustochrepts
*Dennis	Fine, mixed, thermic Aquic Paleudolls
Dougherty	Loamy, mixed, thermic Arenic Haplustalfs
*Eram	Fine, mixed, thermic Aquic Argiudolls
Eufaula	Sandy, siliceous, thermic Psammentic Paleustalfs
Gaddy	Sandy, mixed, thermic Typic Ustifluvents
Gowton	Fine-loamy, mixed, thermic Cumulic Hapludolls
Gracemont	Coarse-loamy, mixed (calcareous), thermic Aquic Udifluvents
Gracemore	Sandy, mixed, thermic Aquic Udifluvents
Grainola	Fine, mixed, thermic Vertic Haplustalfs
Harjo	Fine, mixed (calcareous), thermic Typic Fluvaquents
Keokuk	Coarse-silty, mixed, thermic Fluventic Haplustolls
Konawa	Fine-loamy, mixed, thermic Ultic Haplustalfs
Lucien	Loamy, mixed, thermic, shallow Typic Haplustolls
Madill	Coarse-loamy, mixed, nonacid, thermic Typic Udifluvents
*Newtonia	Fine-silty, mixed, thermic Typic Paleudolls
Niotaze	Fine, montmorillonitic, thermic Aquic Paleustalfs
*Okemah	Fine, mixed, thermic Aquic Paleudolls
*Prue	Fine-loamy, siliceous, thermic Mollic Paleudalfs
Roebuck	Fine, montmorillonitic, thermic Vertic Hapludolls
*Seminole	Fine, mixed, thermic Typic Natrustolls
Shidler	Loamy, mixed, thermic Lithic Haplustolls
*Stephenville	Fine-loamy, siliceous, thermic Ultic Haplustalfs
Teller	Fine-loamy, mixed, thermic Udic Argiustolls
*Tullahassee	Coarse-loamy, mixed, nonacid, thermic Aquic Udifluvents
Waurika	Fine, montmorillonitic, thermic Typic Argialbolls
Wewoka	Sandy-skeletal, siliceous, thermic Typic Ustorthents
Wynona	Fine-silty, mixed, thermic Cumulic Haplaquolls
Yahola	Coarse-loamy, mixed (calcareous), thermic Typic Ustifluvents

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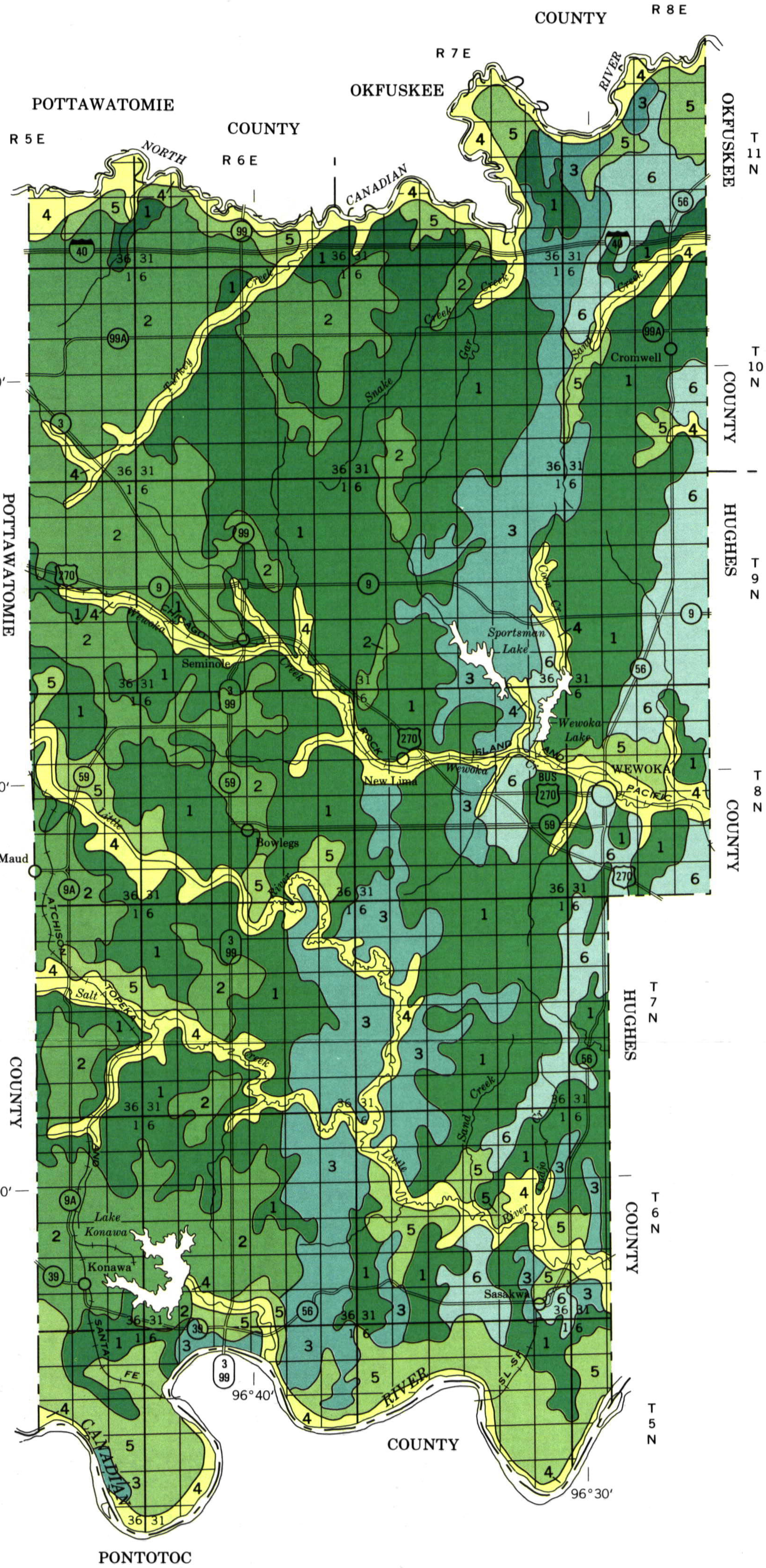


LEGEND*

1 STEPHENVILLE–DARNELL: Moderately deep to shallow, very gently sloping to strongly sloping, well drained loamy soils that formed under oak forest with an understory of grasses in material weathered from sandstone; on uplands

2 SEMINOLE–CHICKASHA–GRAINOLA: Deep to moderately deep, very gently sloping to strongly sloping, moderately well drained to well drained loamy soils that formed under grasses in material weathered from sandstone or shale; on uplands

3 NIOTAZE–DARNELL–WEWOKA: Moderately deep and shallow, gently sloping to steep, somewhat poorly drained to somewhat excessively drained loamy soils that formed under oak forest with an understory of grasses in material weathered from sandstone, shale, or cherty conglomerate; on uplands

4 GOWTON–MADILL–YAHOLA: Deep, nearly level, well drained loamy soils that formed under grasses in loamy sediment; on flood plains

5 KONAWA–EUFAULA–TELLER: Deep, very gently sloping to strongly sloping, well drained to somewhat excessively drained loamy and sandy soils that formed under grasses or under oak forest with an understory of grasses in loamy and sandy sediments; on uplands.

6 OKEMAH–BATES–PRUE: Deep to moderately deep, nearly level to sloping, moderately well drained to well drained loamy soils that formed under grasses in material weathered from sandstone or shale; on uplands

*Terms for texture refer to the surface layer of the major soils in each unit

Compiled 1977

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
OKLAHOMA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

SEMINOLE COUNTY, OKLAHOMA

Scale 1:253,440

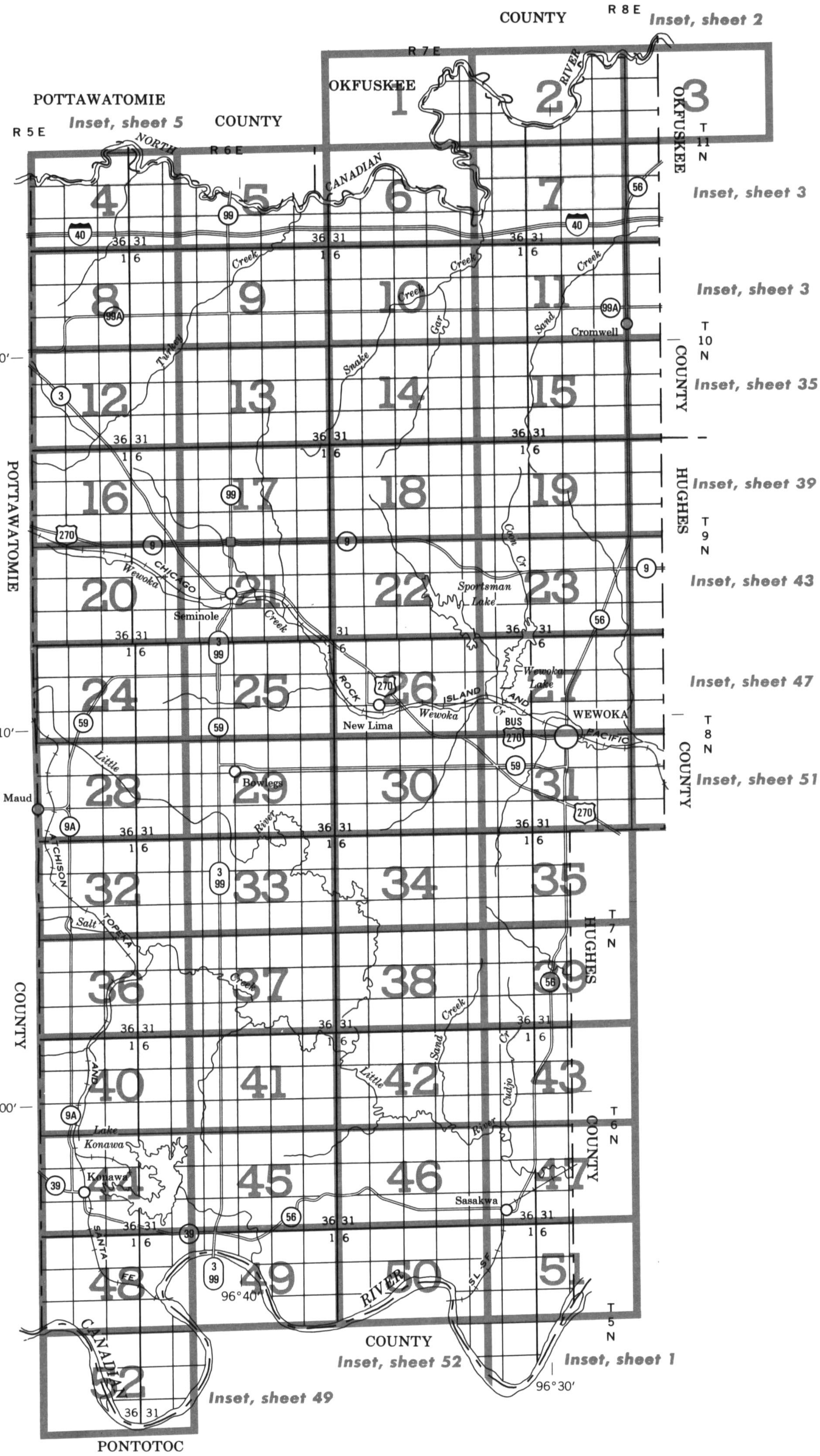
1 0 1 2 3 4 Miles

N

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

N

INDEX TO MAP SHEETS

SEMINOLE COUNTY, OKLAHOMA

Scale 1:253,440

1 0 1 2 3 4 Miles

SOIL LEGEND

One or two Arabic numbers are used to identify the published map symbol. The symbol (W) following the soil name indicates that signs of erosion, especially of local shifting of soil by wind, are evident in places, but the degree of erosion cannot be readily estimated.

SYMBOL	NAME
1	Asher silty clay loam
2	Aydelotte loam, 2 to 5 percent slopes
3	Bates loam, 1 to 3 percent slopes
4	Bates loam, 3 to 5 percent slopes
5	Bates-Coweta complex, 2 to 5 percent slopes
6	Chickasha loam, 2 to 5 percent slopes
7	Dennis loam, 3 to 5 percent slopes
8	Dougherty loamy fine sand, 3 to 8 percent slopes (W)
9	Eram-Coweta complex, 3 to 12 percent slopes
10	Eufaula-Dougherty complex, 0 to 3 percent slopes (W)
11	Eufaula-Dougherty complex, 3 to 12 percent slopes (W)
12	Gaddy loamy fine sand
13	Gowton loam
14	Gowton soils
15	Gracemont fine sandy loam
16	Gracemore loamy fine sand
17	Grainola and Aydelotte soils, 3 to 8 percent slopes, severely eroded
18	Grainola-Lucien complex, 3 to 12 percent slopes
19	Harjo clay
20	Keokuk silt loam
21	Konawa fine sandy loam, 0 to 3 percent slopes
22	Konawa fine sandy loam, 3 to 5 percent slopes
23	Konawa fine sandy loam, 2 to 5 percent slopes, eroded
24	Konawa fine sandy loam, gullied
25	Madill fine sandy loam
26	Newtonia-Catoosa complex, 1 to 3 percent slopes
27	Niotaze-Darnell complex, 8 to 30 percent slopes
28	Niotaze-Wewoka complex, 3 to 12 percent slopes
29	Oil-waste land
30	Okemah silt loam, 0 to 1 percent slopes
31	Okemah silt loam, 1 to 3 percent slopes
32	Okemah-Carytown complex, 0 to 2 percent slopes
33	Pits
34	Prue loam, 1 to 3 percent slopes
35	Prue loam, 3 to 5 percent slopes
36	Roebuck clay
37	Seminole loam, 1 to 3 percent slopes
38	Seminole loam, 2 to 5 percent slopes, eroded
39	Seminole, Chickasha, and Prue soils, 2 to 8 percent slopes, severely eroded
40	Seminole-Gowton complex, 0 to 12 percent slopes
41	Shidler-Rock outcrop complex, 1 to 5 percent slopes
42	Stephenville fine sandy loam, 1 to 3 percent slopes
43	Stephenville fine sandy loam, 3 to 5 percent slopes
44	Stephenville-Darnell complex, 3 to 12 percent slopes
45	Stephenville-Darnell complex, 3 to 12 percent slopes, severely eroded
46	Teller loam, 1 to 3 percent slopes
47	Teller loam, 3 to 5 percent slopes
48	Tullahassee fine sandy loam
49	Waurika silt loam, 0 to 1 percent slopes
50	Wynona silt loam
51	Yahola fine sandy loam

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water; w

PITS

- Gravel pit — Gravel Pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — CeA FoB2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

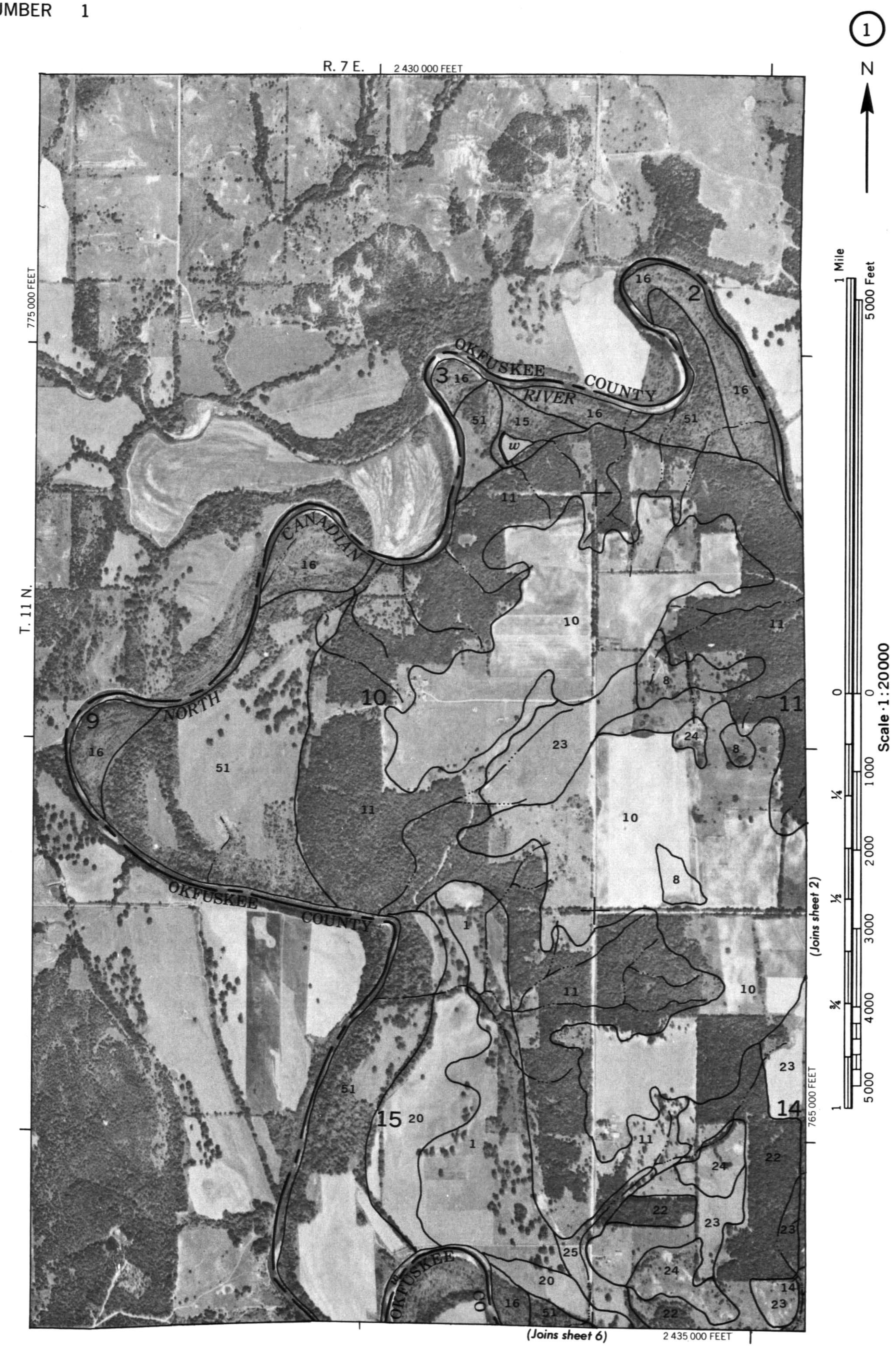
GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot



SEMINOLE COUNTY, OKLAHOMA NO. 1

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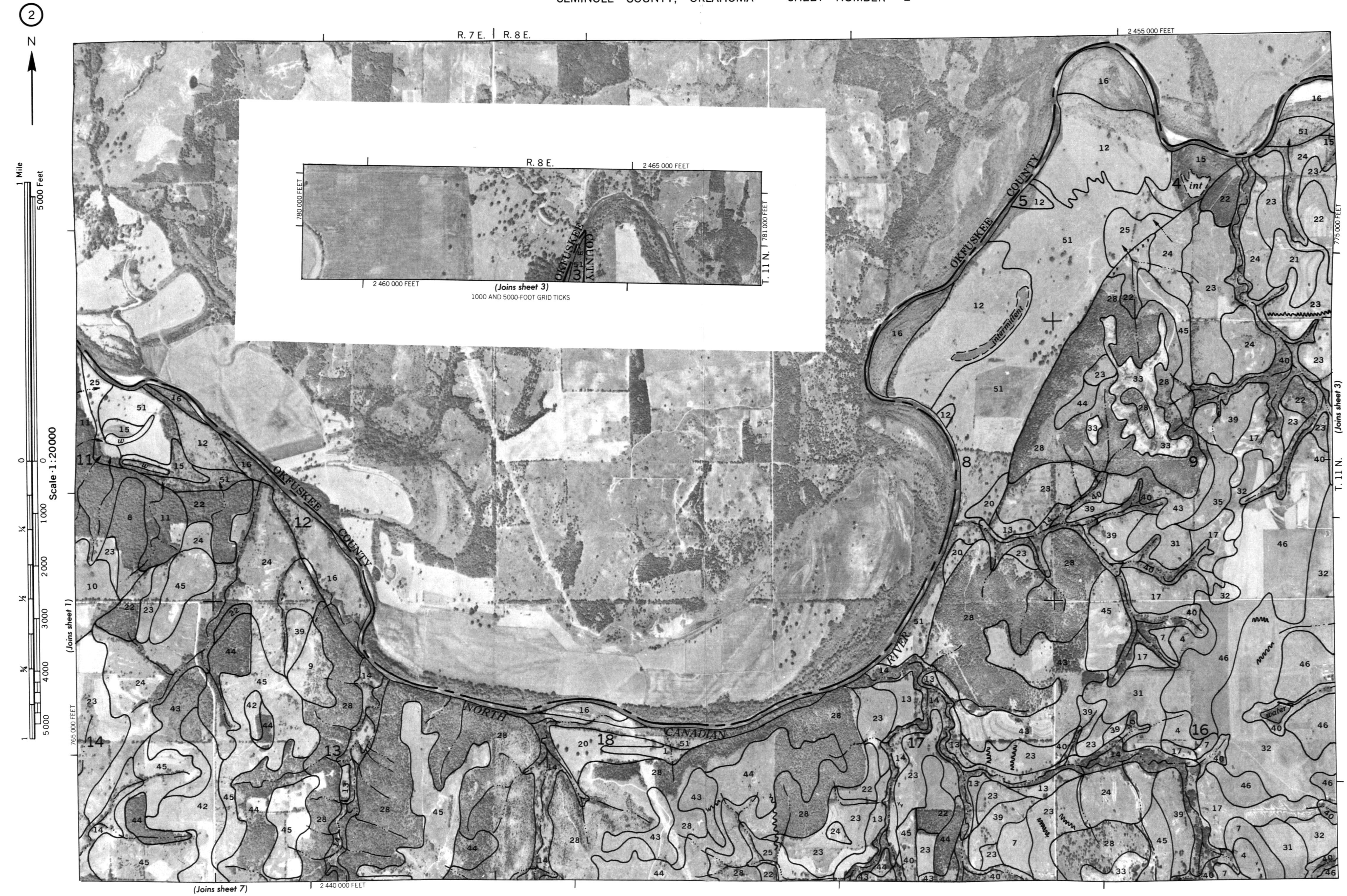

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SEMINOLE COUNTY, OKLAHOMA NO. 2

(3)

SEMINOLE COUNTY, OKLAHOMA NO. 3

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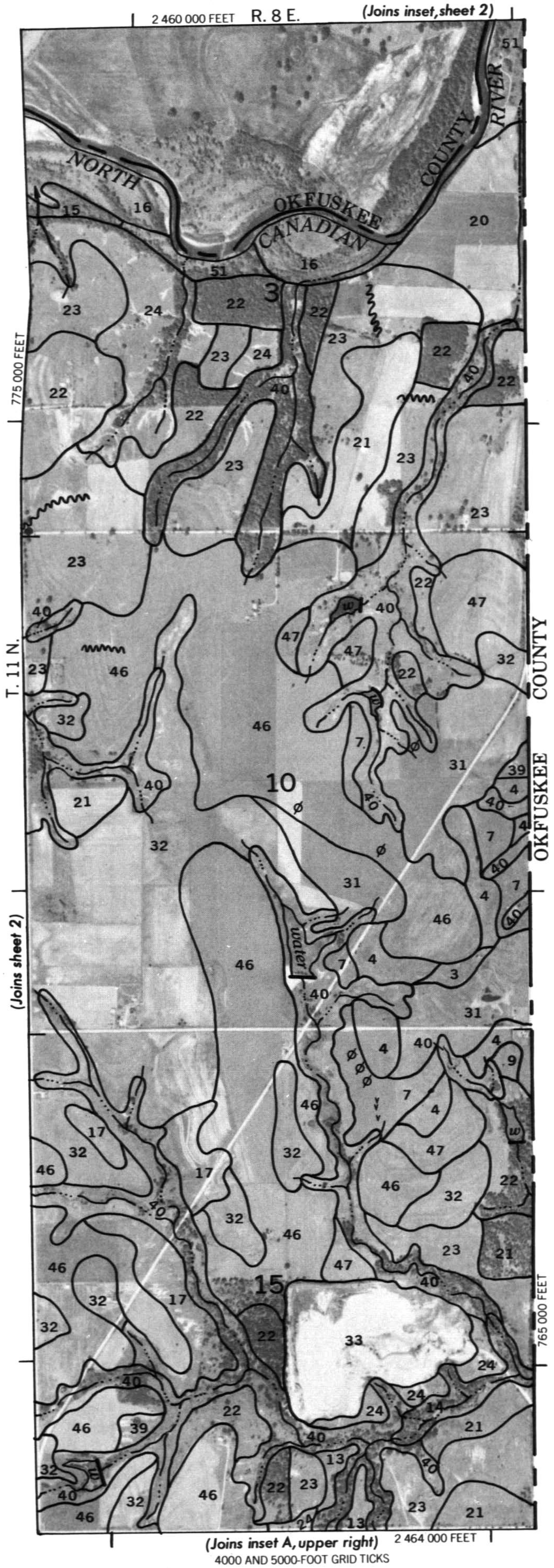
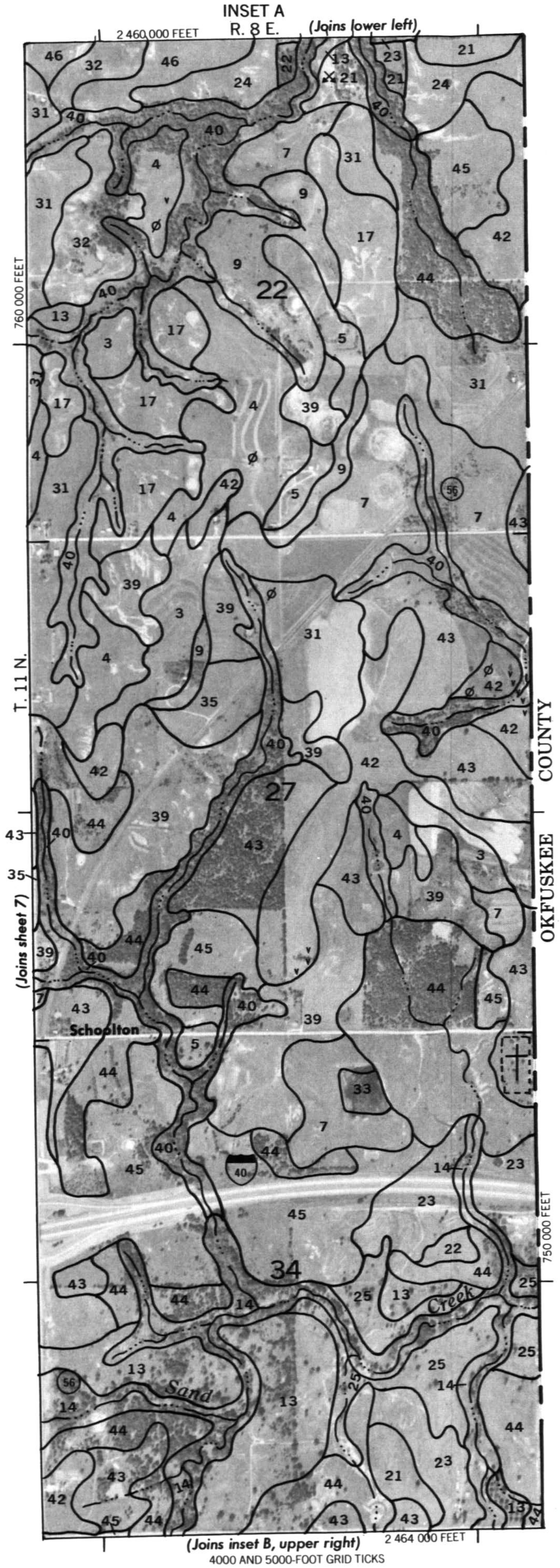
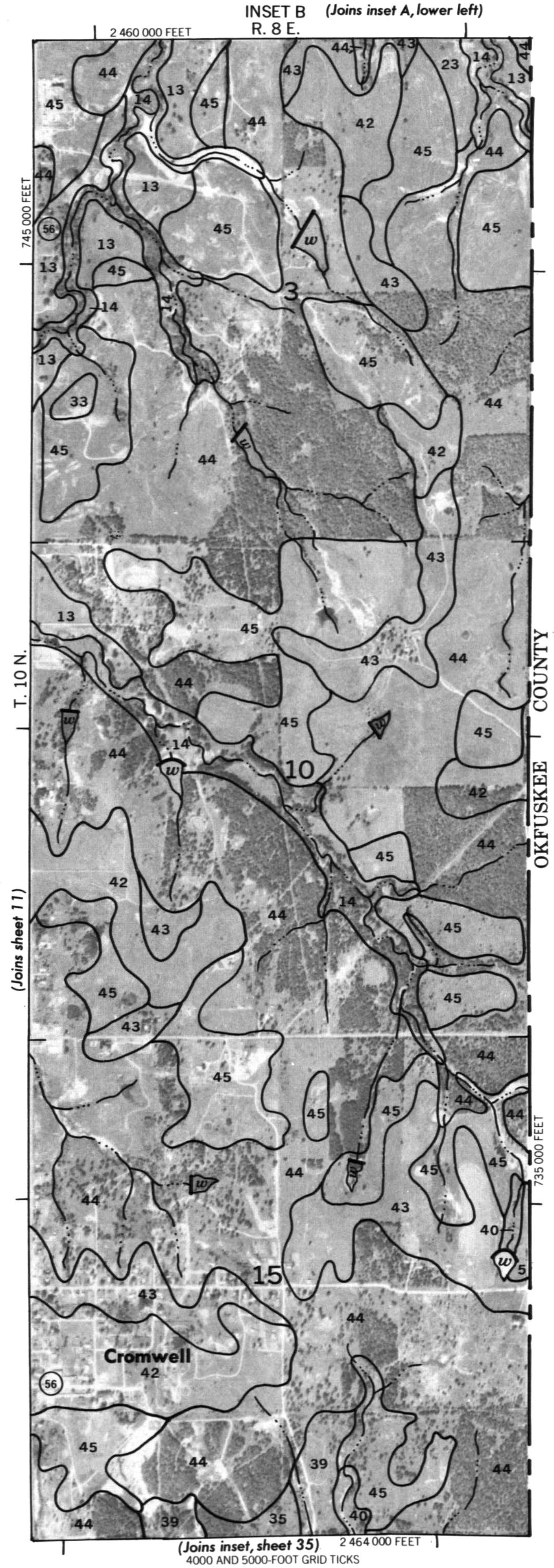


INSET A



INSET B

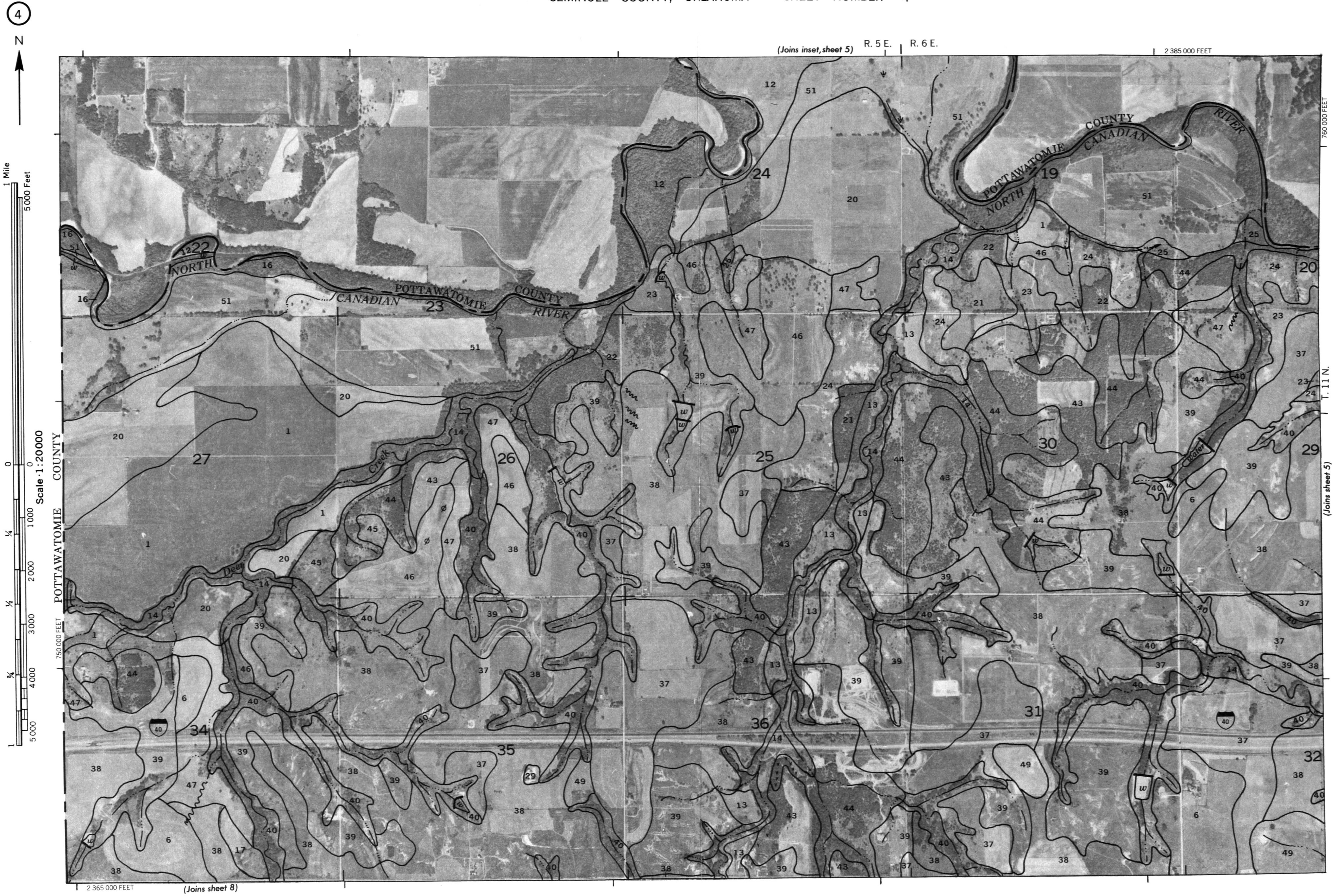


N

1 Mile

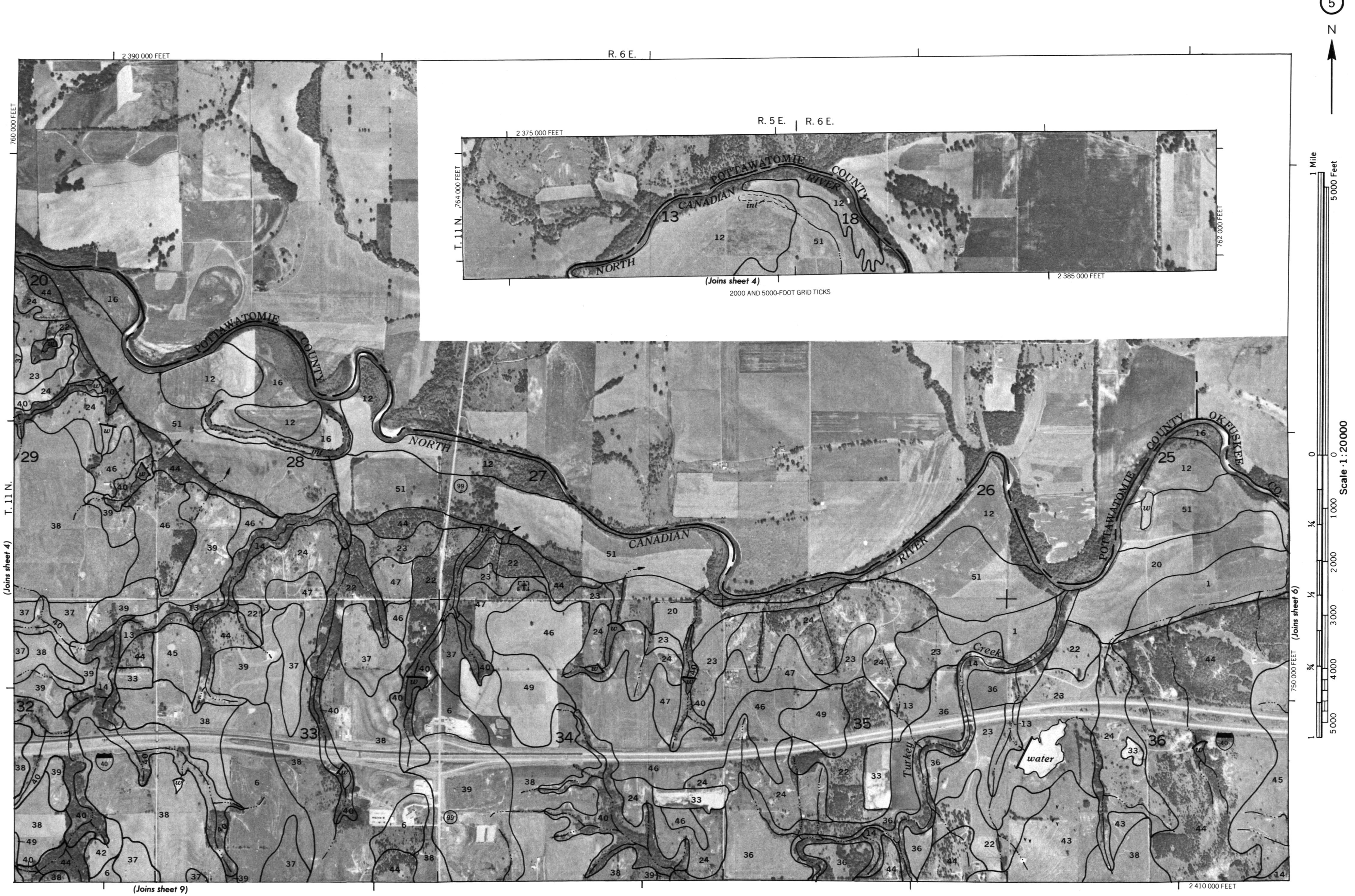
5000 Feet

Scale 1:20000



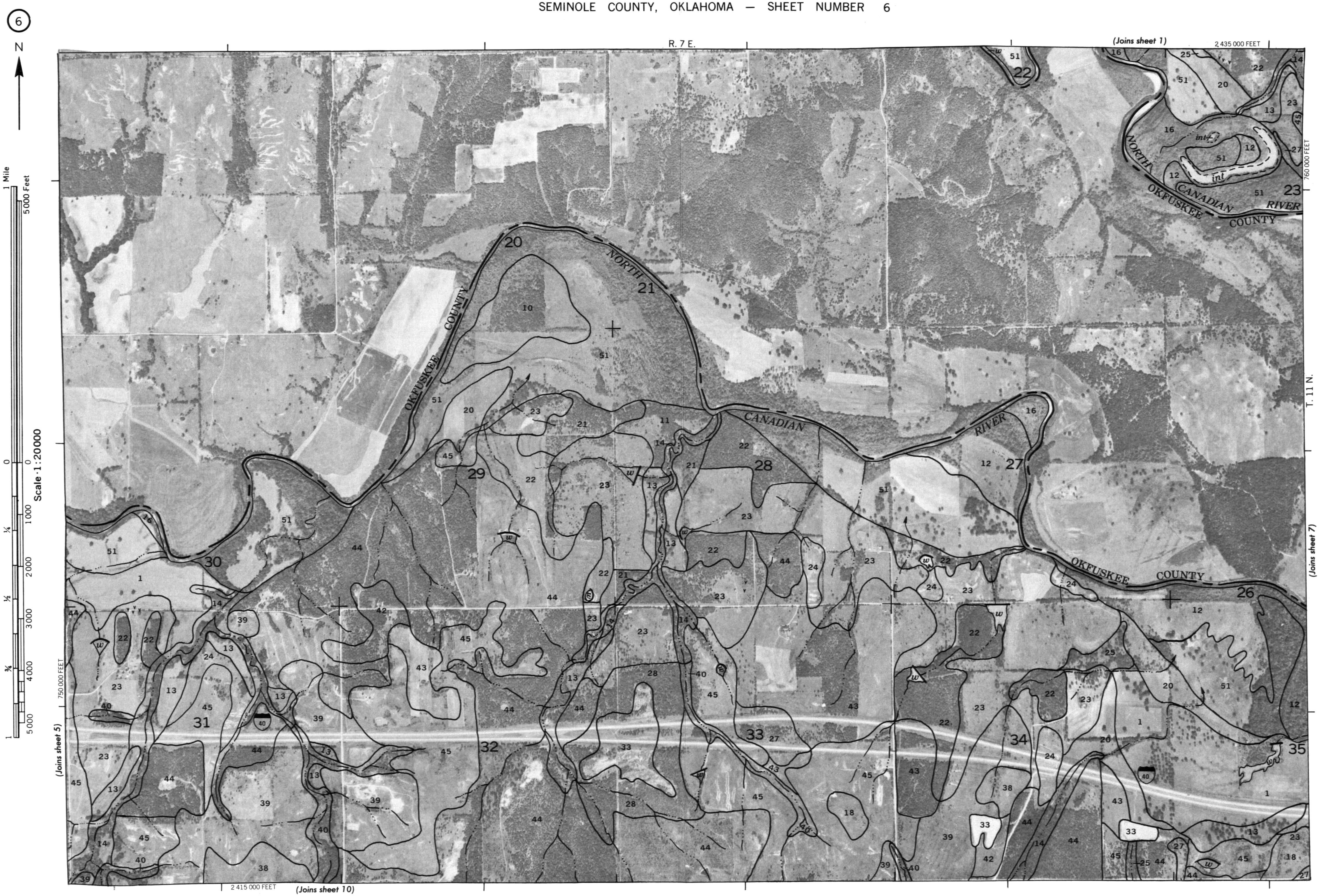
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SEMINOLE COUNTY, OKLAHOMA NO. 4



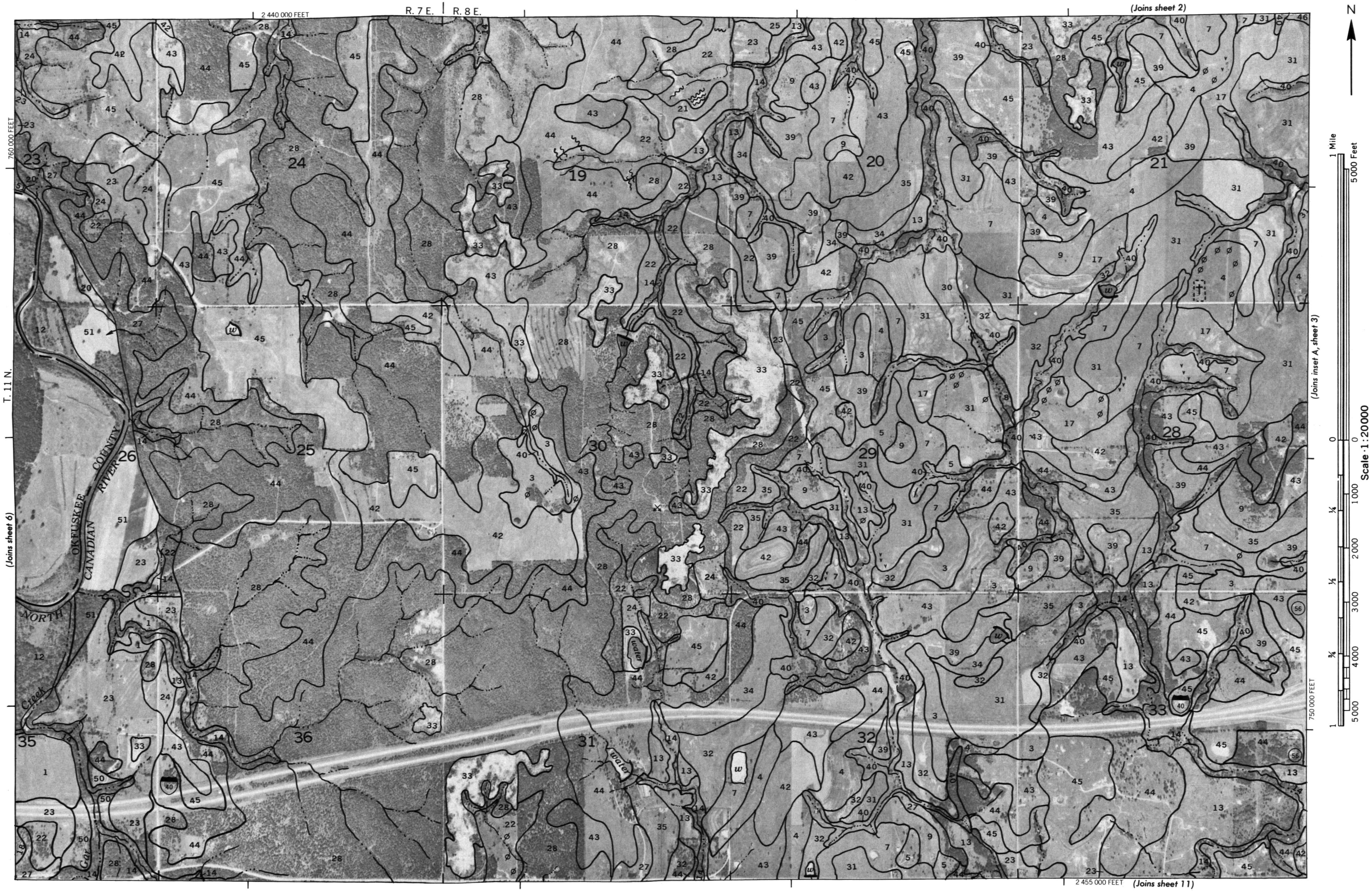
SEMINOLE COUNTY, OKLAHOMA NO. 5

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SEMINOLE COUNTY, OKLAHOMA NO. 6

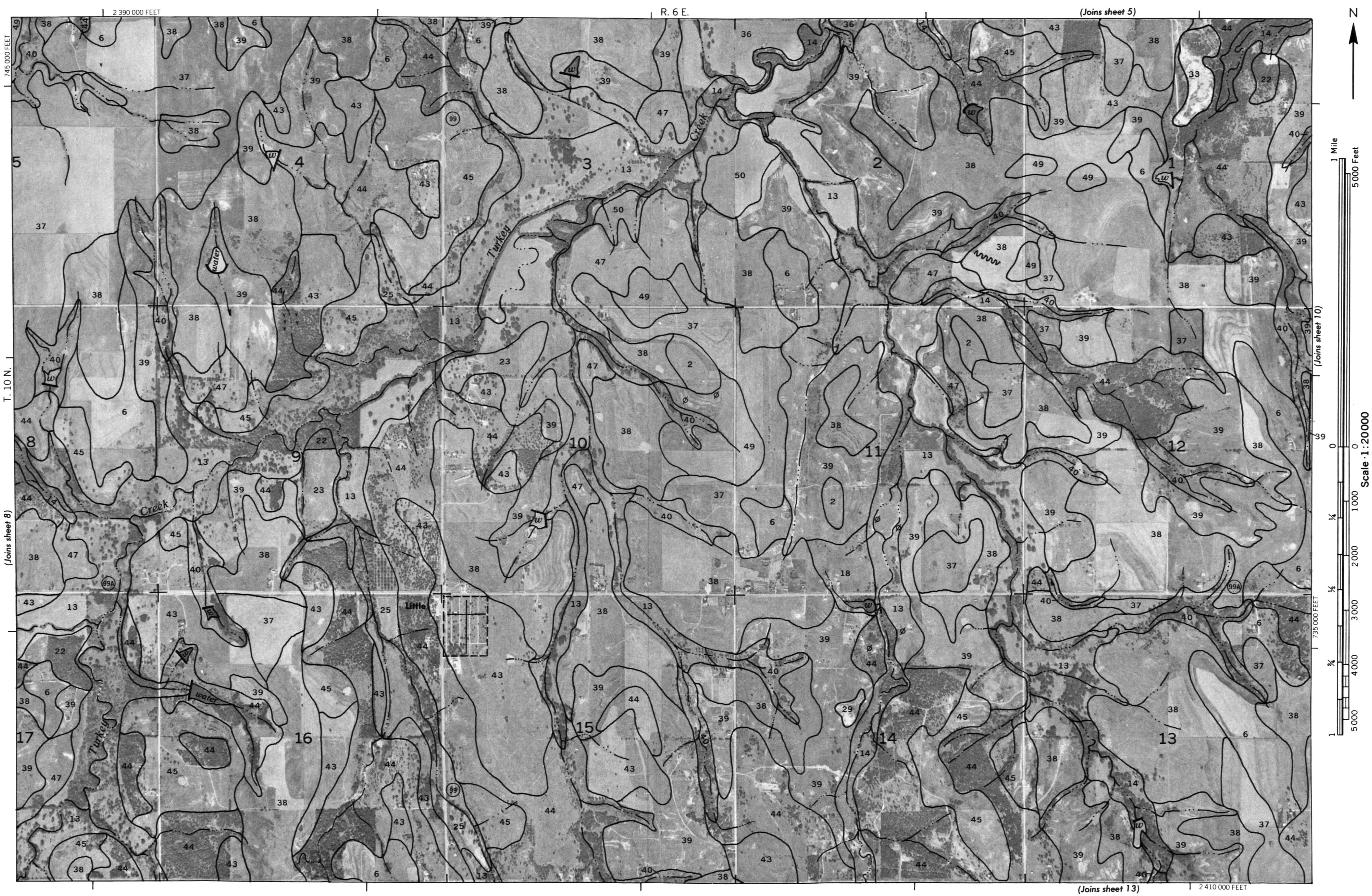


SEMINOLE COUNTY, OKLAHOMA NO. 7
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SEMINOLE COUNTY, OKLAHOMA NO. 8

9

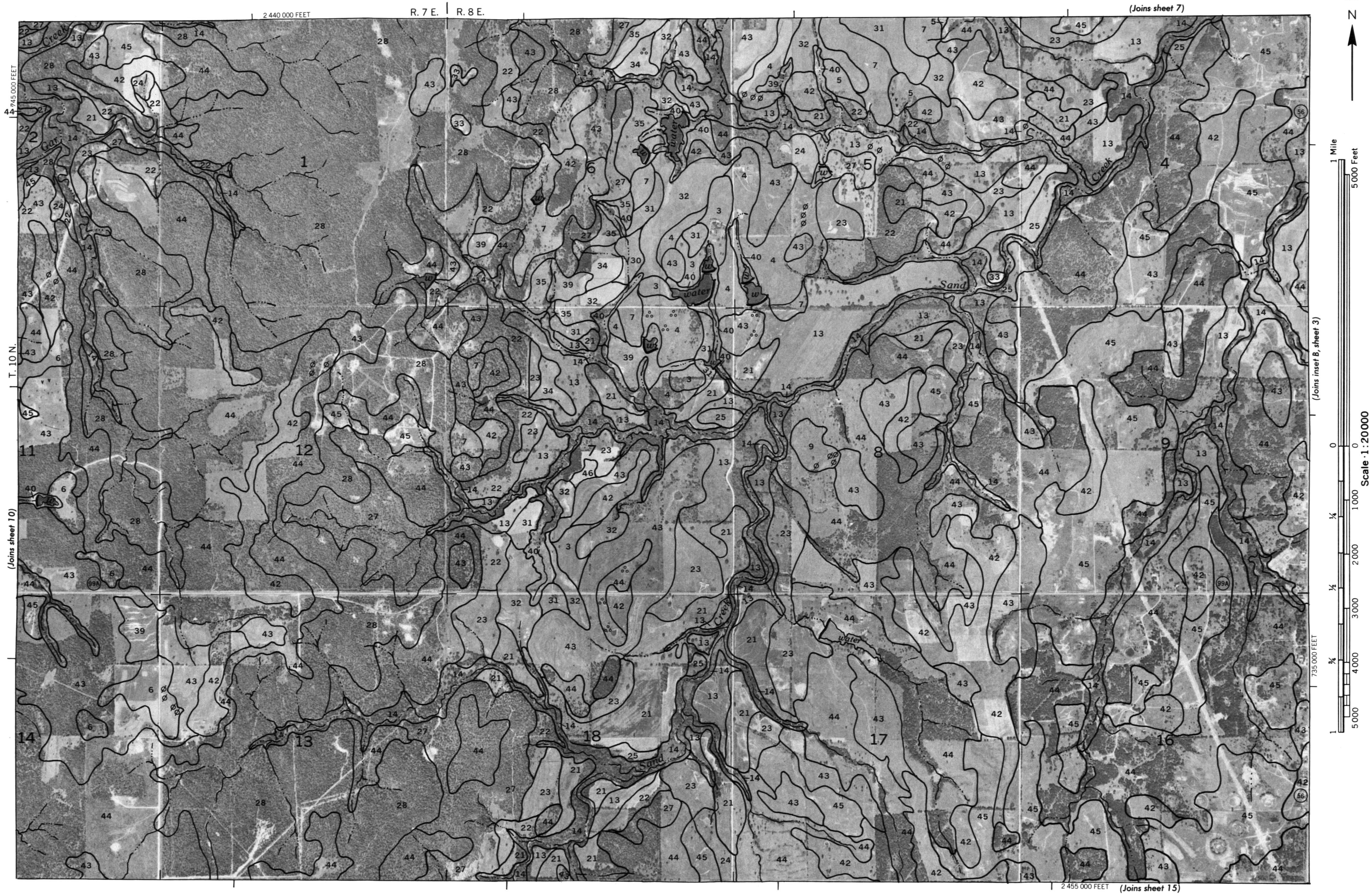


SEMINOLE COUNTY, OKLAHOMA NO. 9

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SEMINOLE COUNTY, OKLAHOMA NO. 10



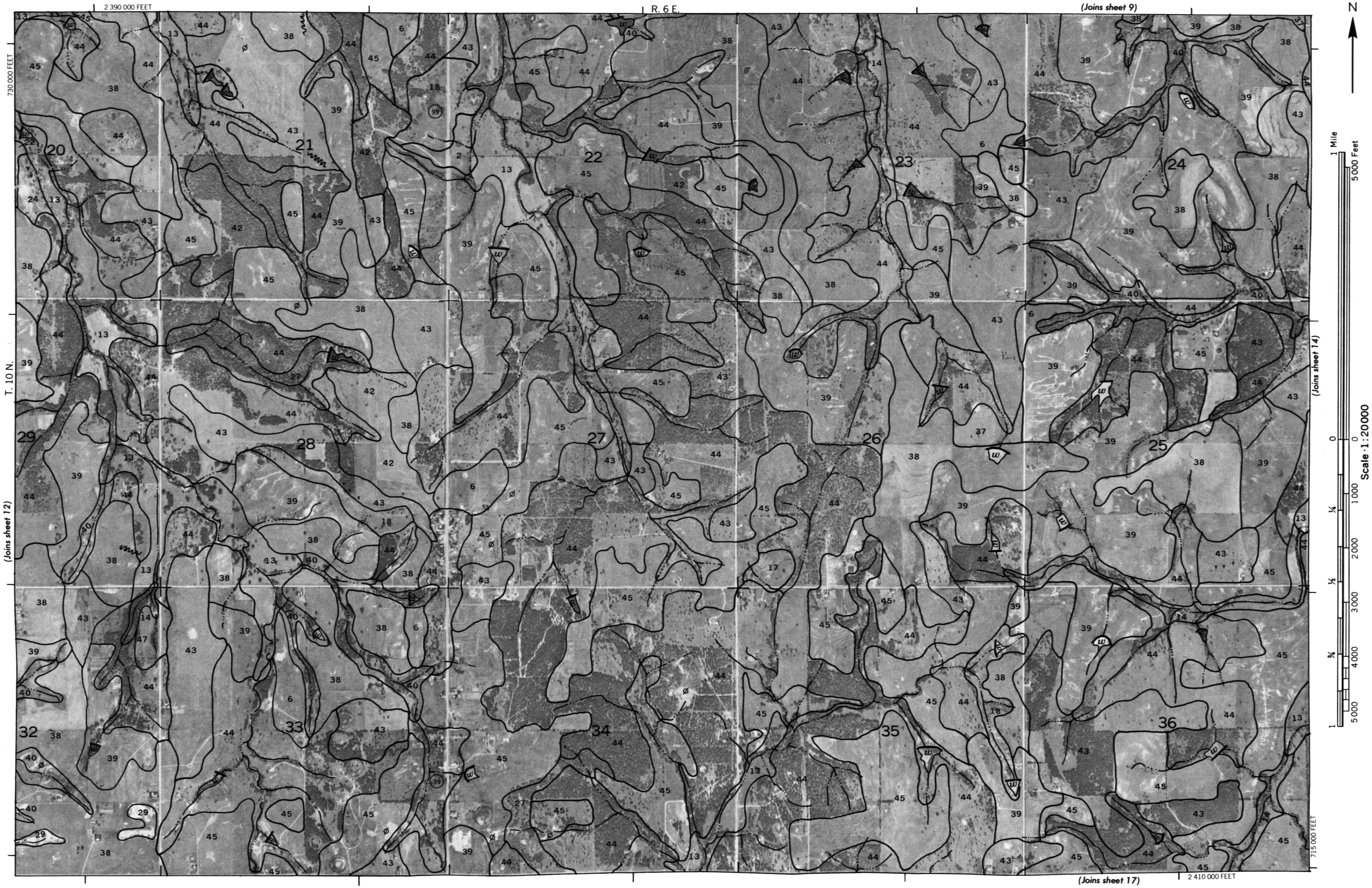
SEMINOLE COUNTY, OKLAHOMA NO. 11

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

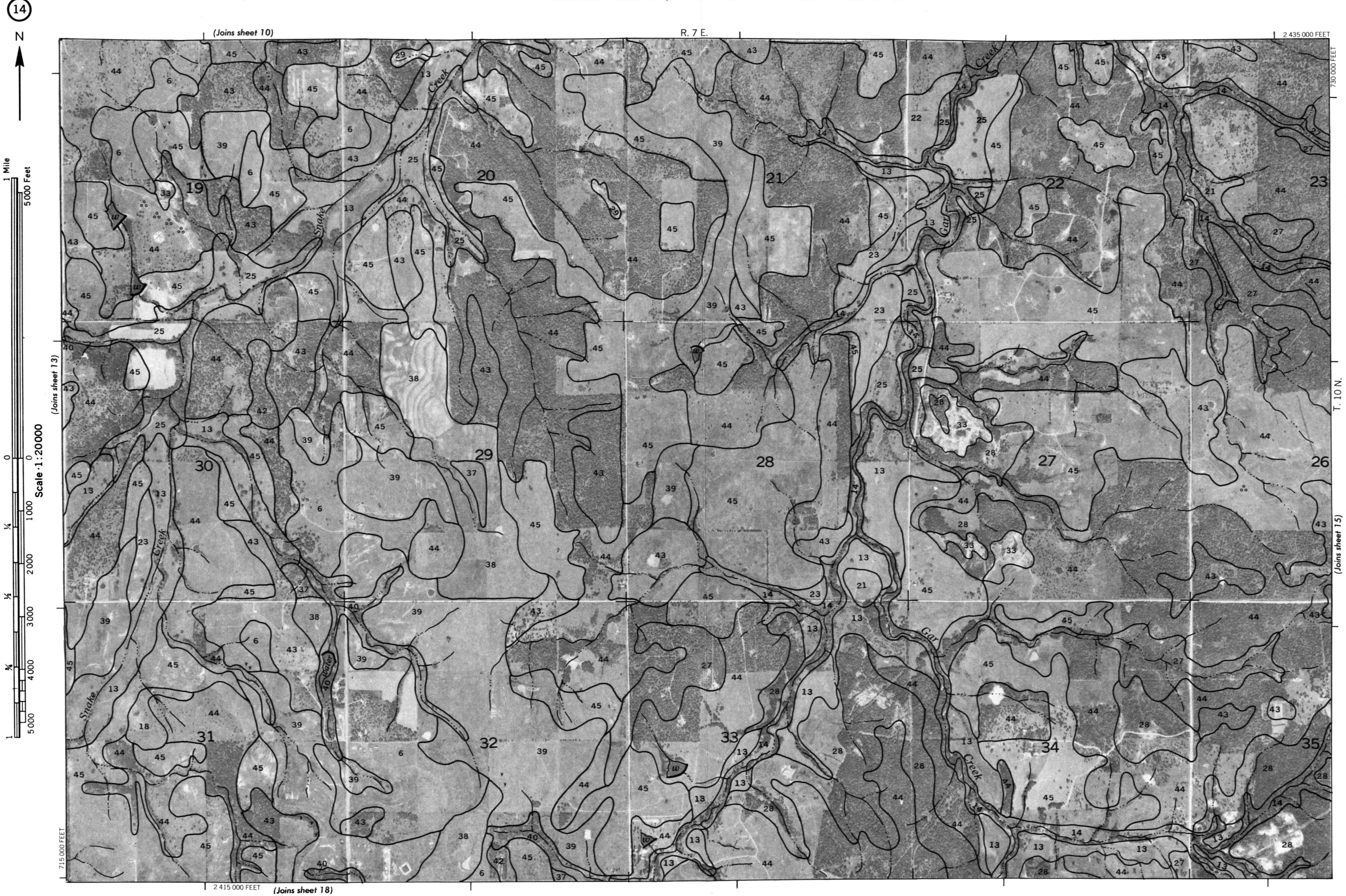
SEMINOLE COUNTY, OKLAHOMA NO. 12

13



SEMINOLE COUNTY, OKLAHOMA NO. 13

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



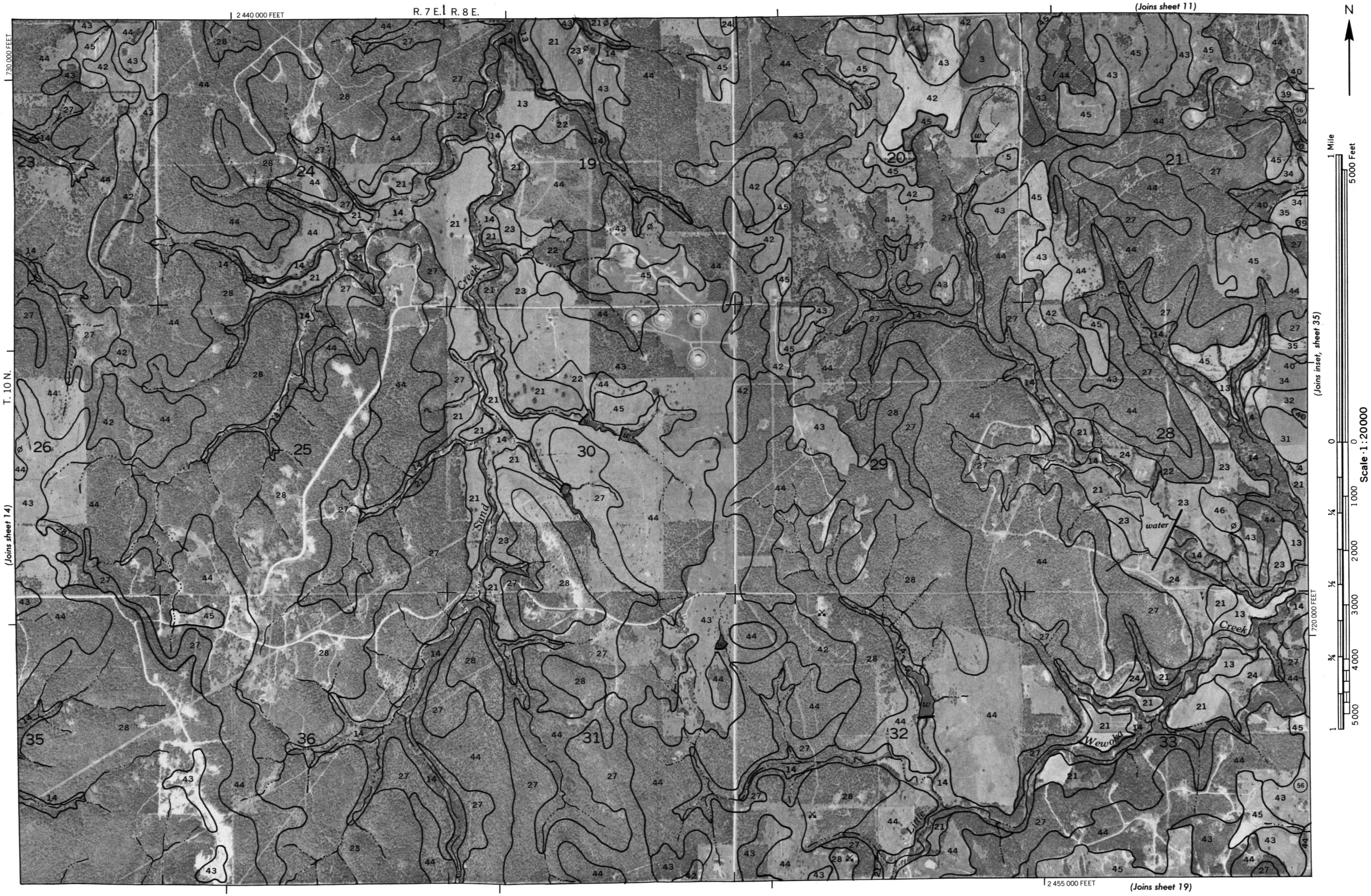
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

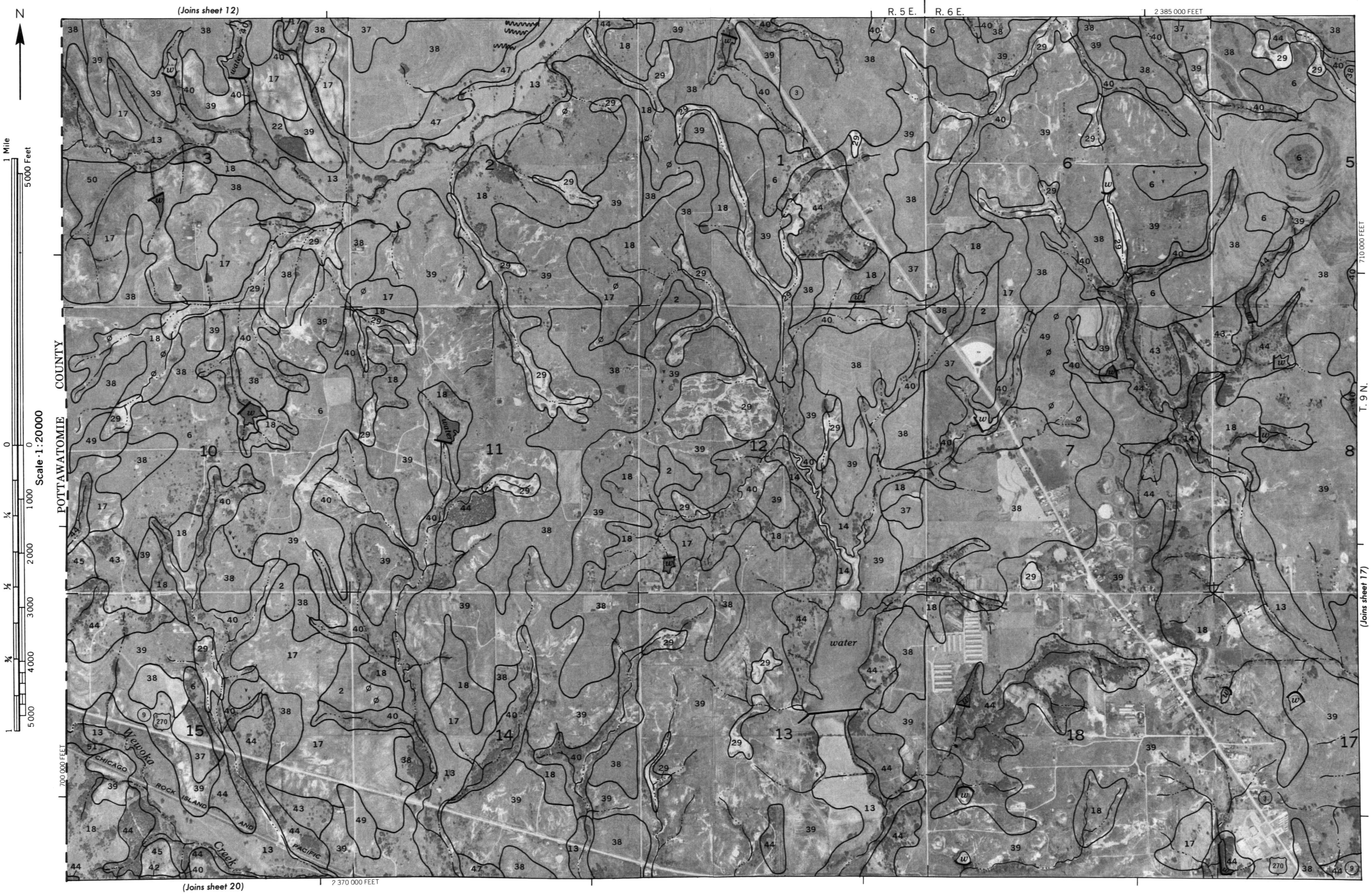
SEMINOLE COUNTY, OKLAHOMA NO. 14

15

SEMINOLE COUNTY, OKLAHOMA NO. 15

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.





This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

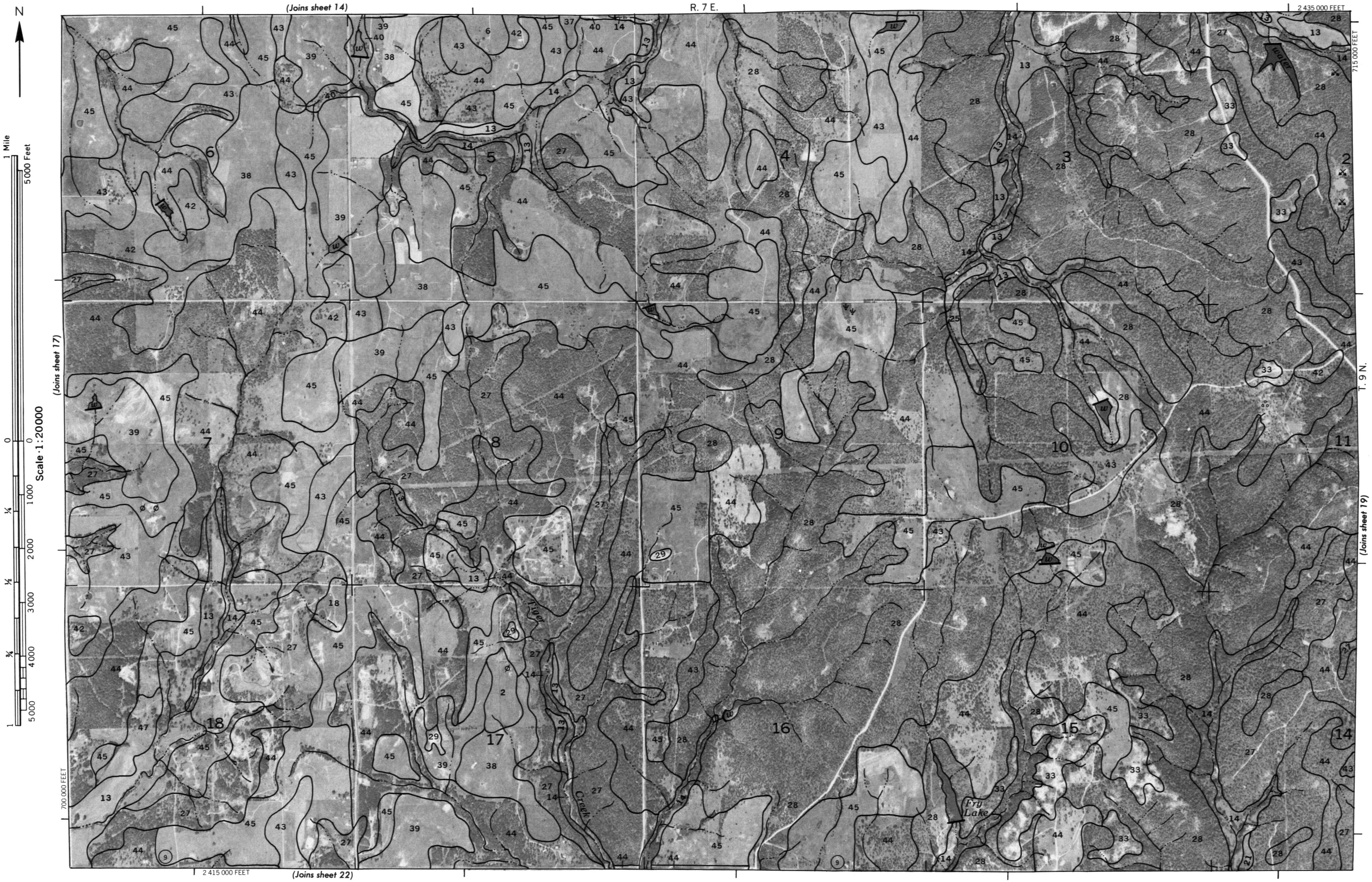
SEMINOLE COUNTY, OKLAHOMA NO. 16

N

1 Mile
5000 Feet
Scale 1:20000

SEMINOLE COUNTY, OKLAHOMA NO. 17

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

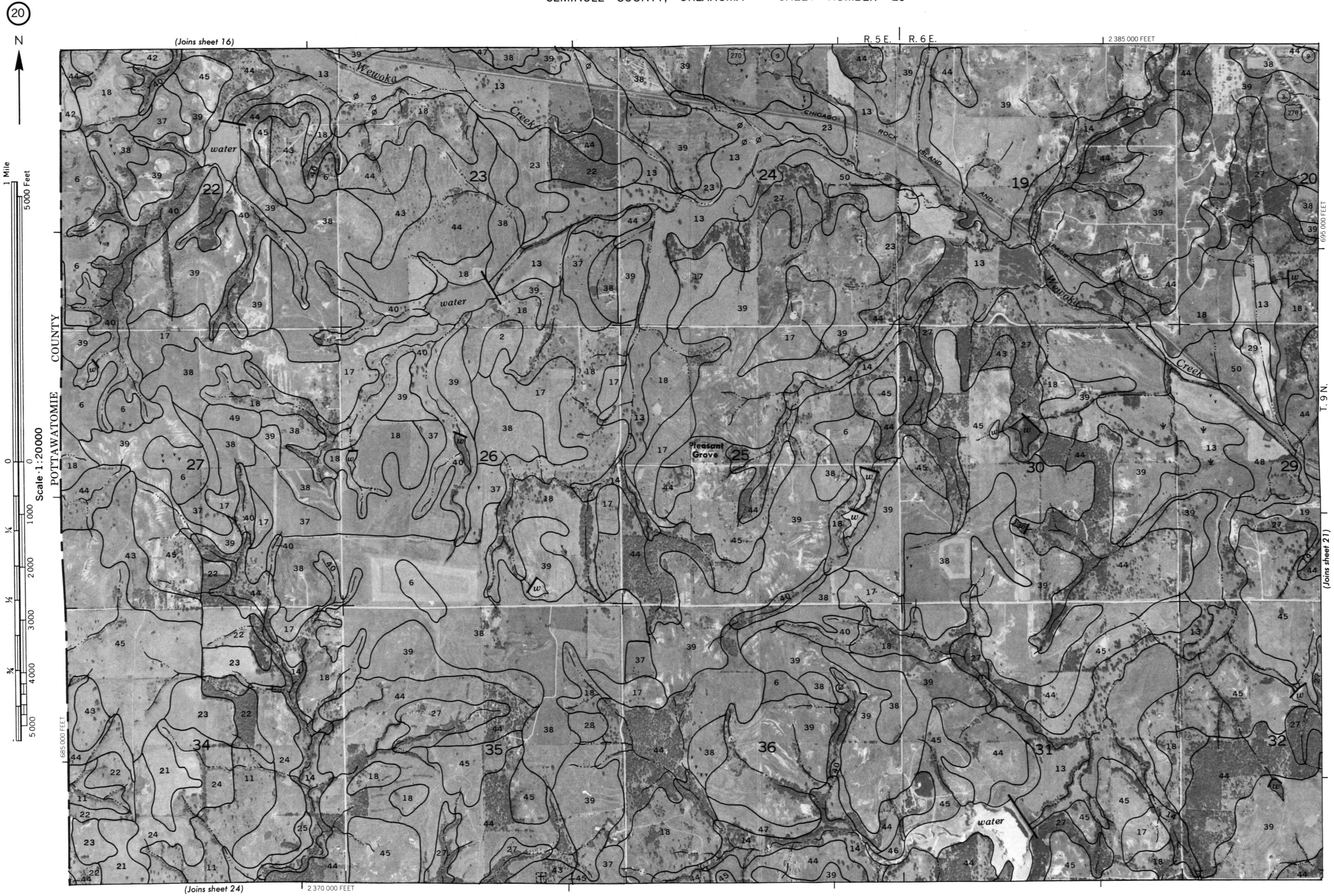


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

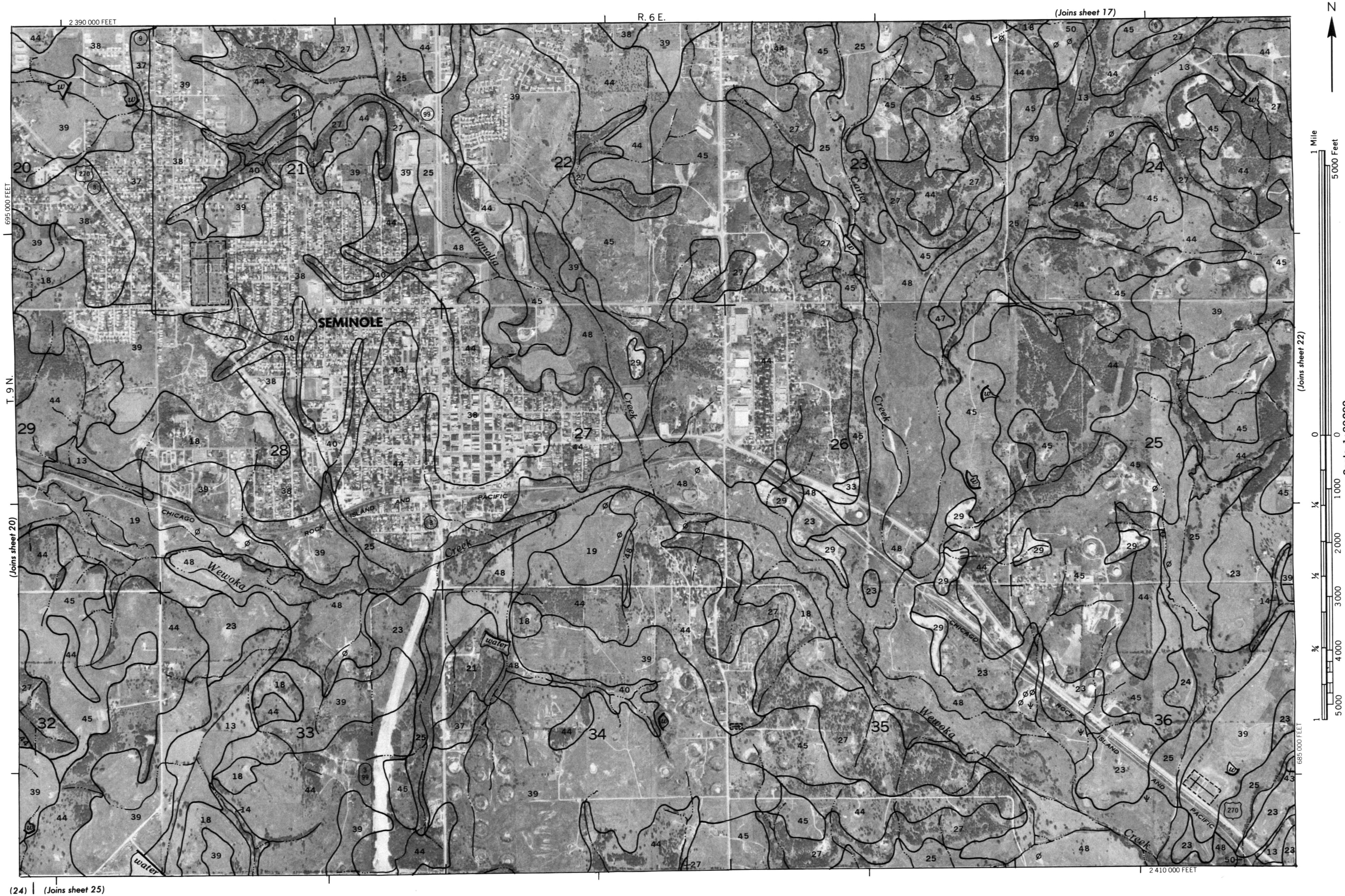
SEMINOLE COUNTY, OKLAHOMA NO. 18

SEMINOLE COUNTY, OKLAHOMA NO. 19

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

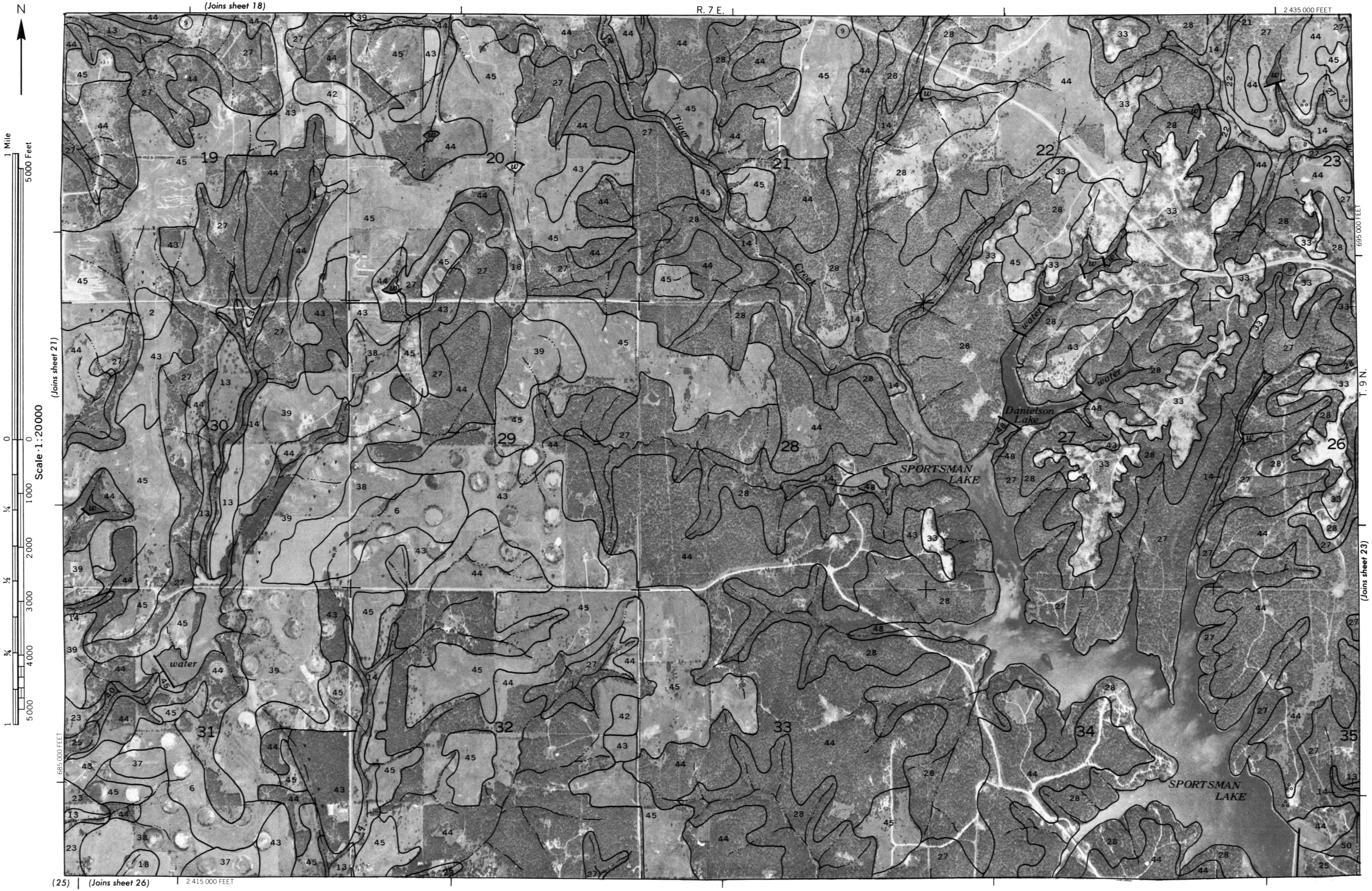


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

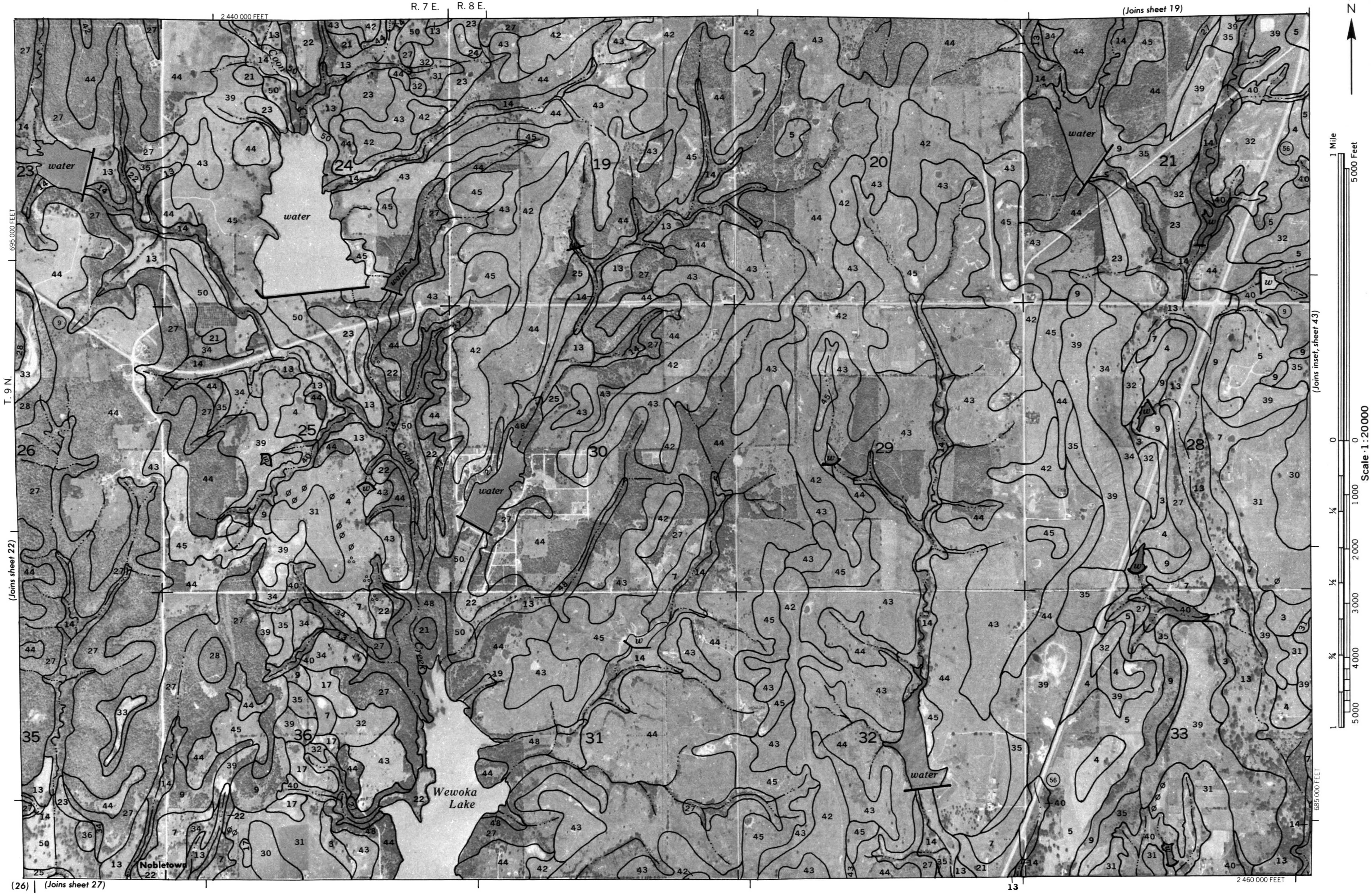


SEMINOLE COUNTY, OKLAHOMA NO. 21

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



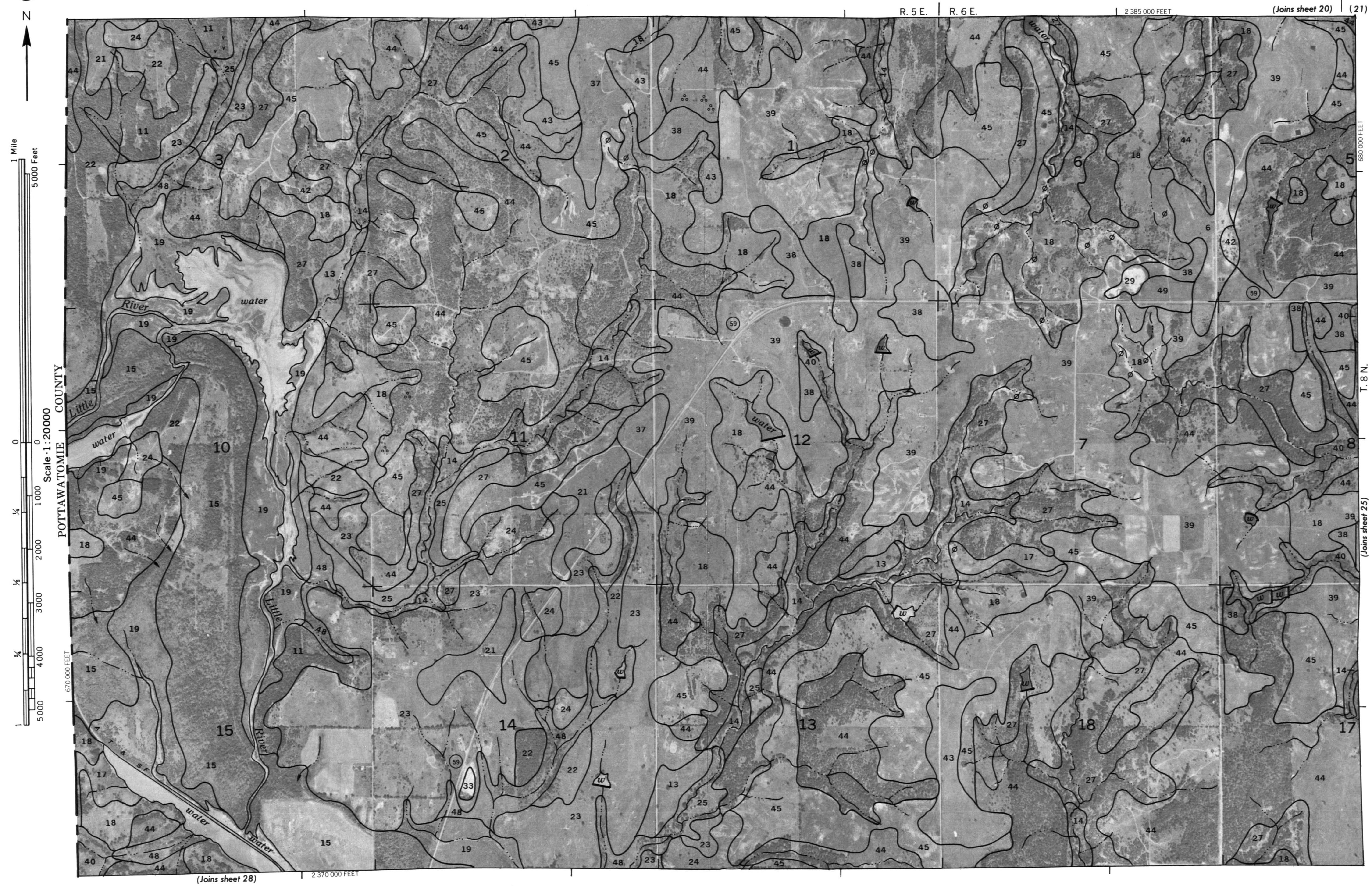
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



SEMINOLE COUNTY, OKLAHOMA NO. 23

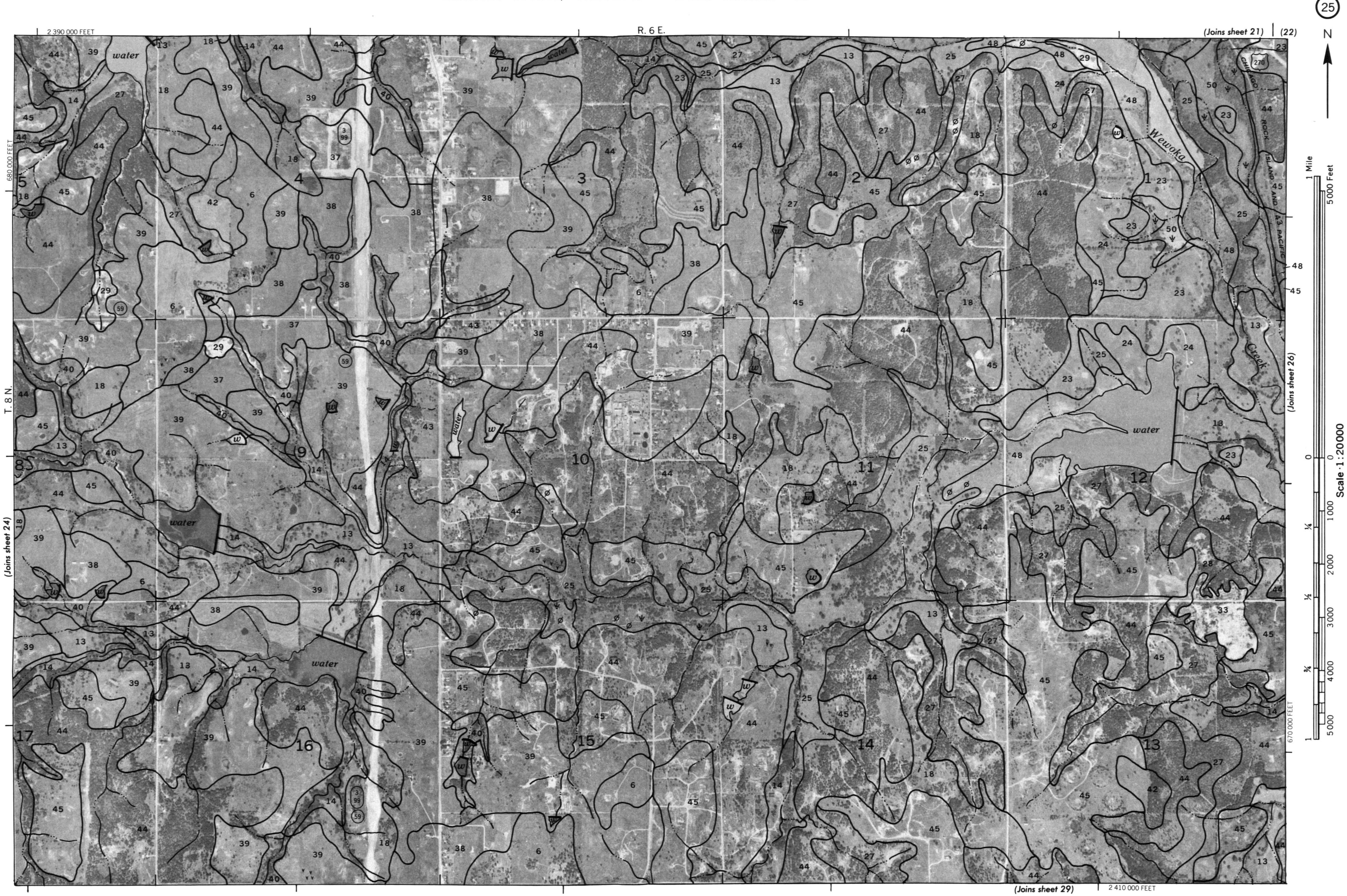
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

24



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SEMINOLE COUNTY, OKLAHOMA NO. 24



SEMINOLE COUNTY, OKLAHOMA NO. 25

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

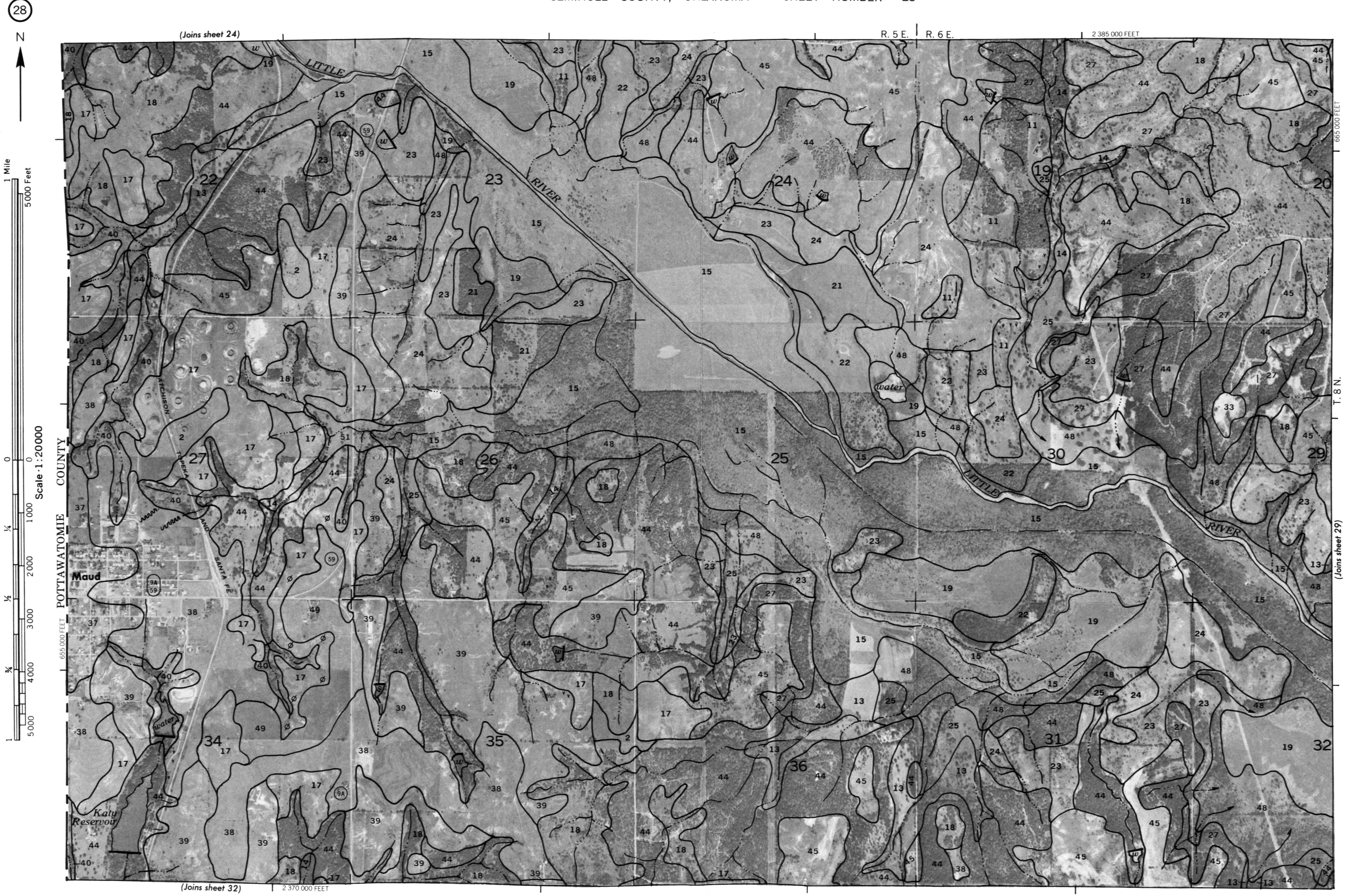
SEMINOLE COUNTY, OKLAHOMA — SHEET NUMBER 26

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

27

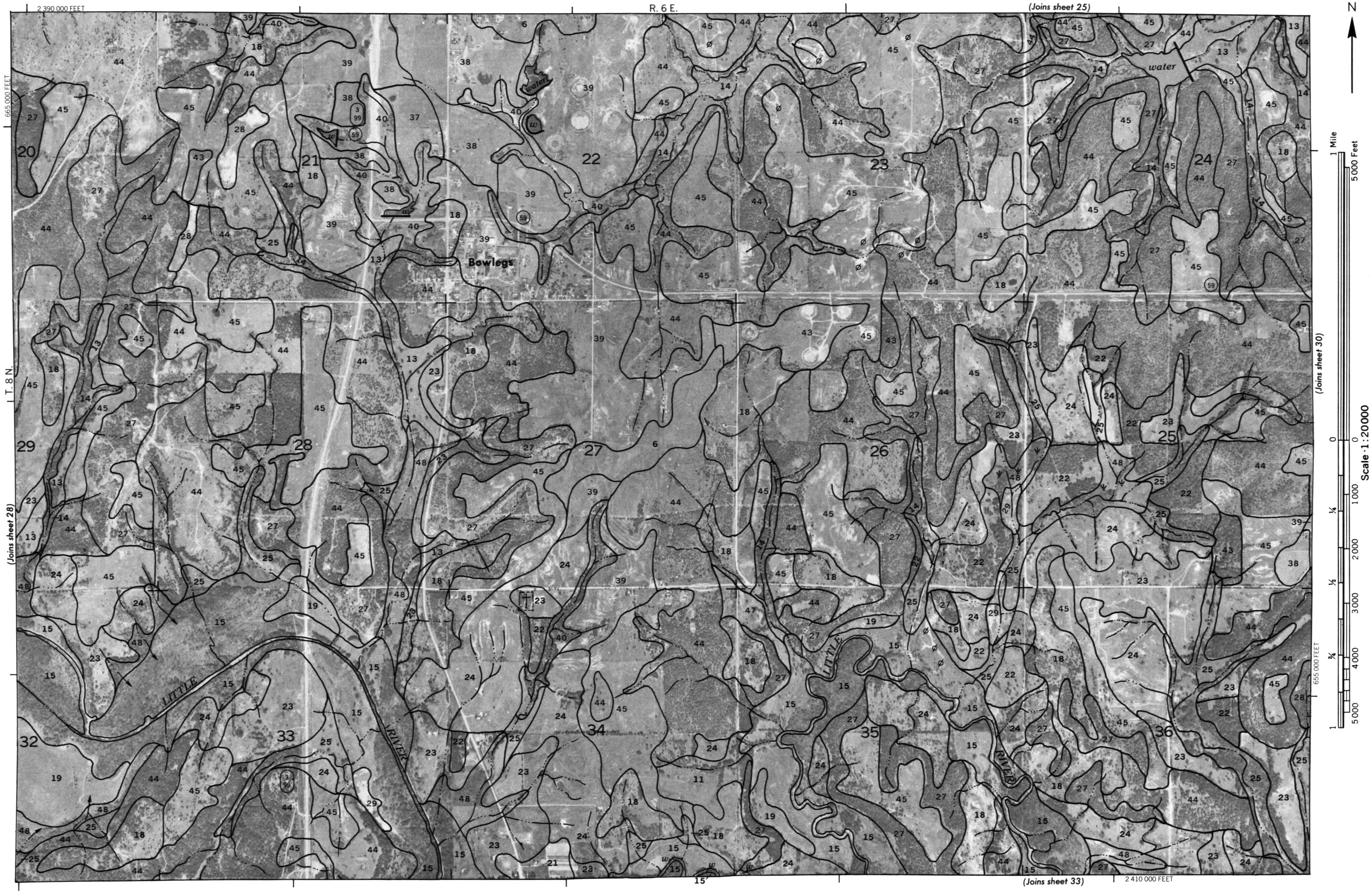
SEMINOLE COUNTY, OKLAHOMA NO. 27

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SEMINOLE COUNTY, OKLAHOMA NO. 28



SEMINOLE COUNTY, OKLAHOMA NO. 29

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SEMINOLE COUNTY, OKLAHOMA NO. 30

SEMINOLE COUNTY, OKLAHOMA NO. 31

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

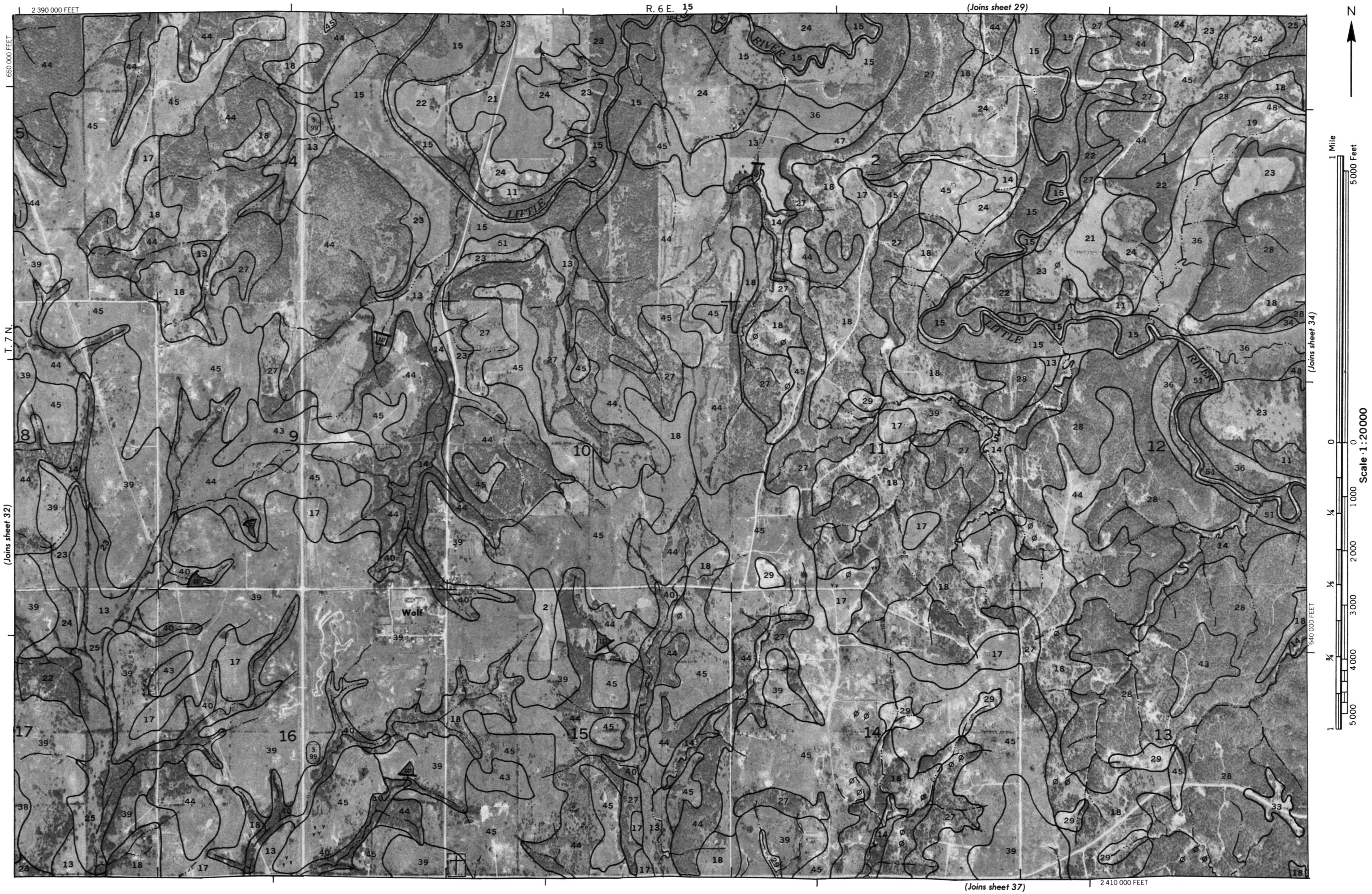
32

N

1 Mile
5000 Feet
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000
Scale 1:20000

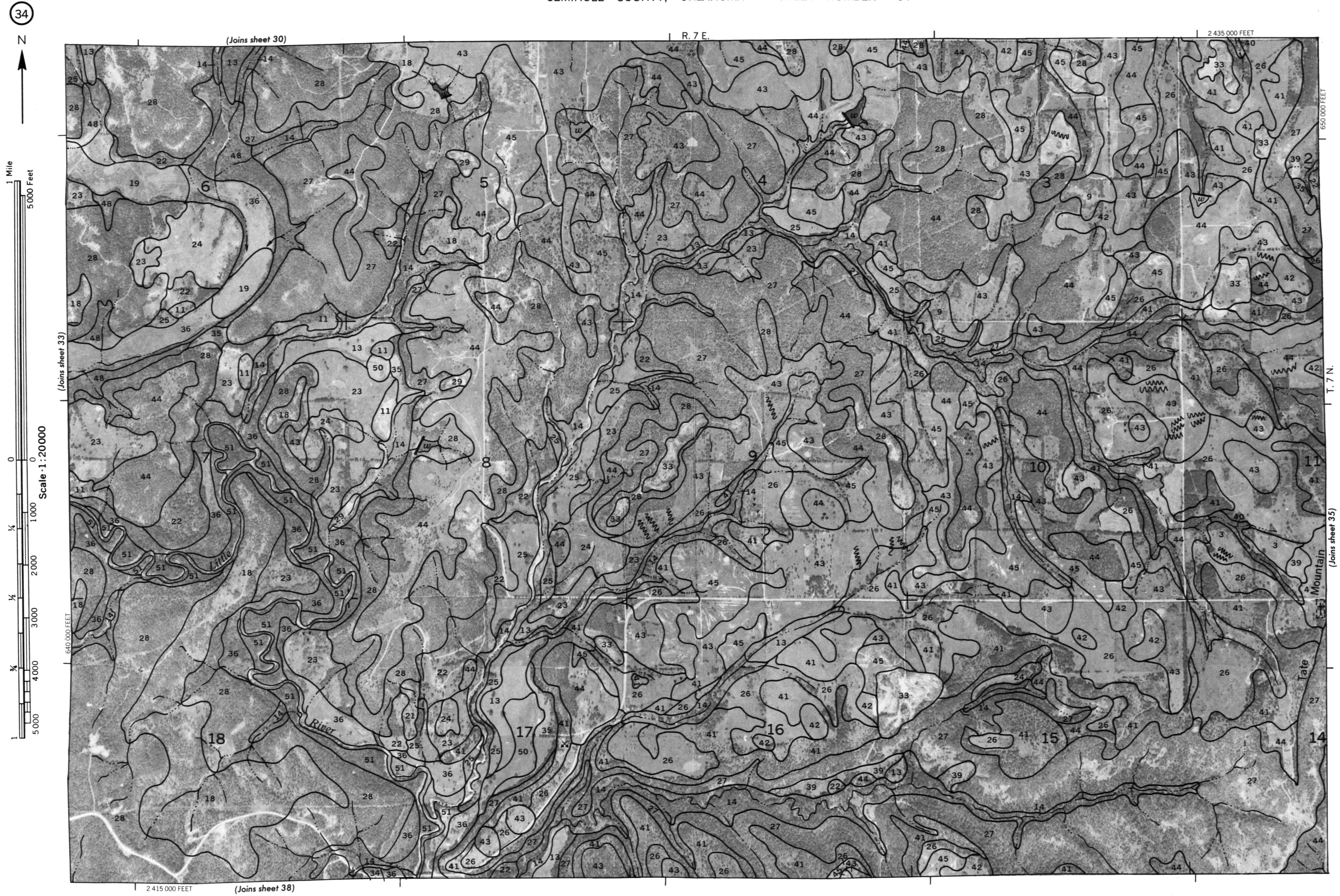
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SEMINOLE COUNTY, OKLAHOMA NO. 32



SEMINOLE COUNTY, OKLAHOMA NO. 33

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SEMINOLE COUNTY, OKLAHOMA NO. 35

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

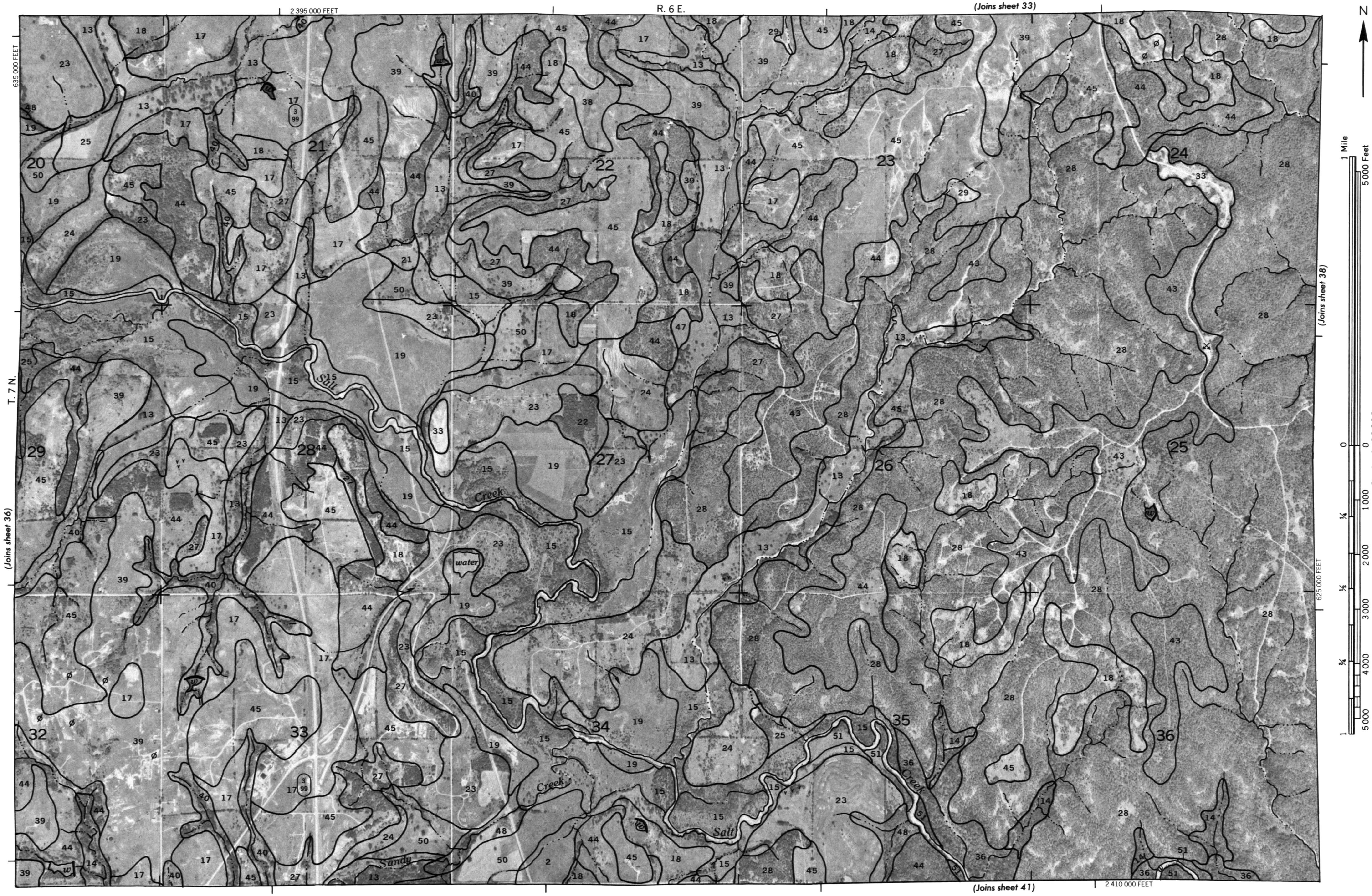
SEMINOLE COUNTY, OKLAHOMA — SHEET NUMBER 36

N

1 Mile
5 000 Feet
Scale 1:20000

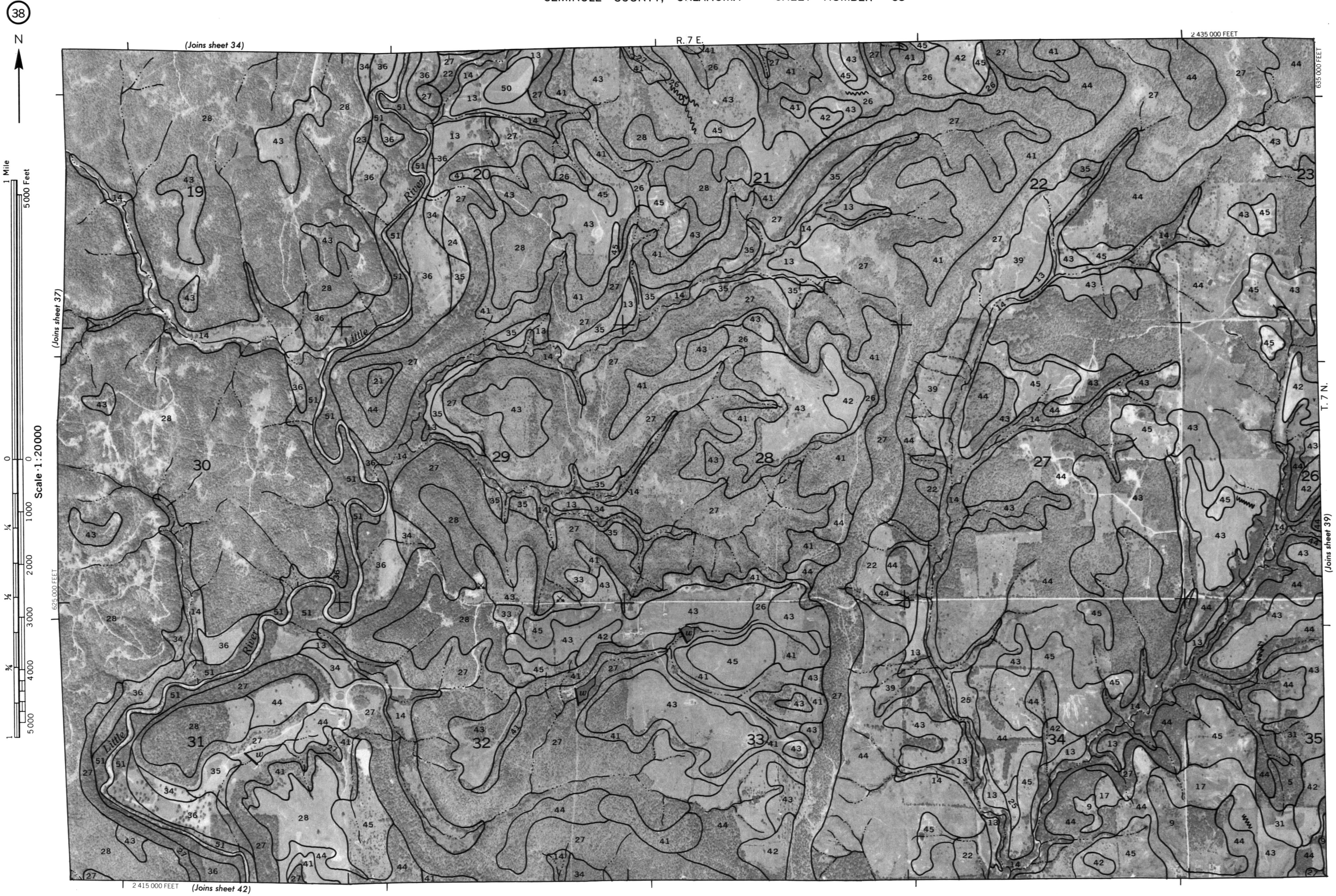
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

37



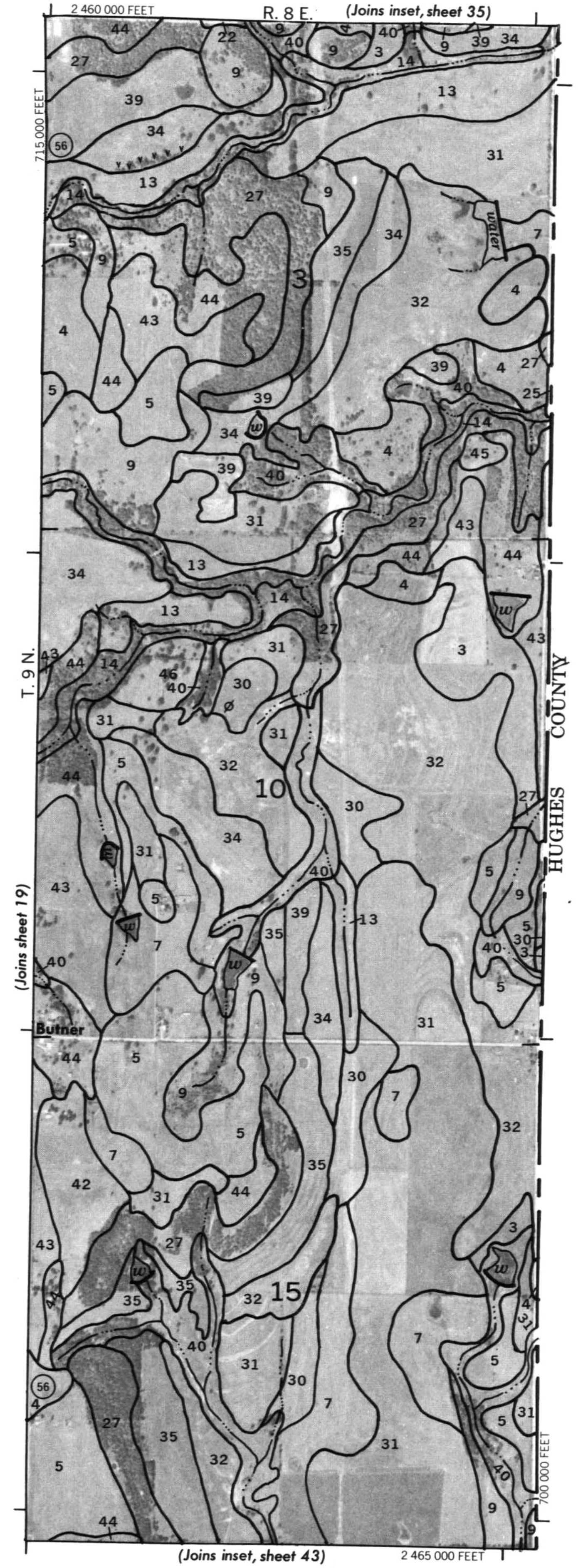
SEMINOLE COUNTY, OKLAHOMA NO. 37

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SEMINOLE COUNTY, OKLAHOMA NO. 38



SEMINOLE COUNTY, OKLAHOMA NO. 39

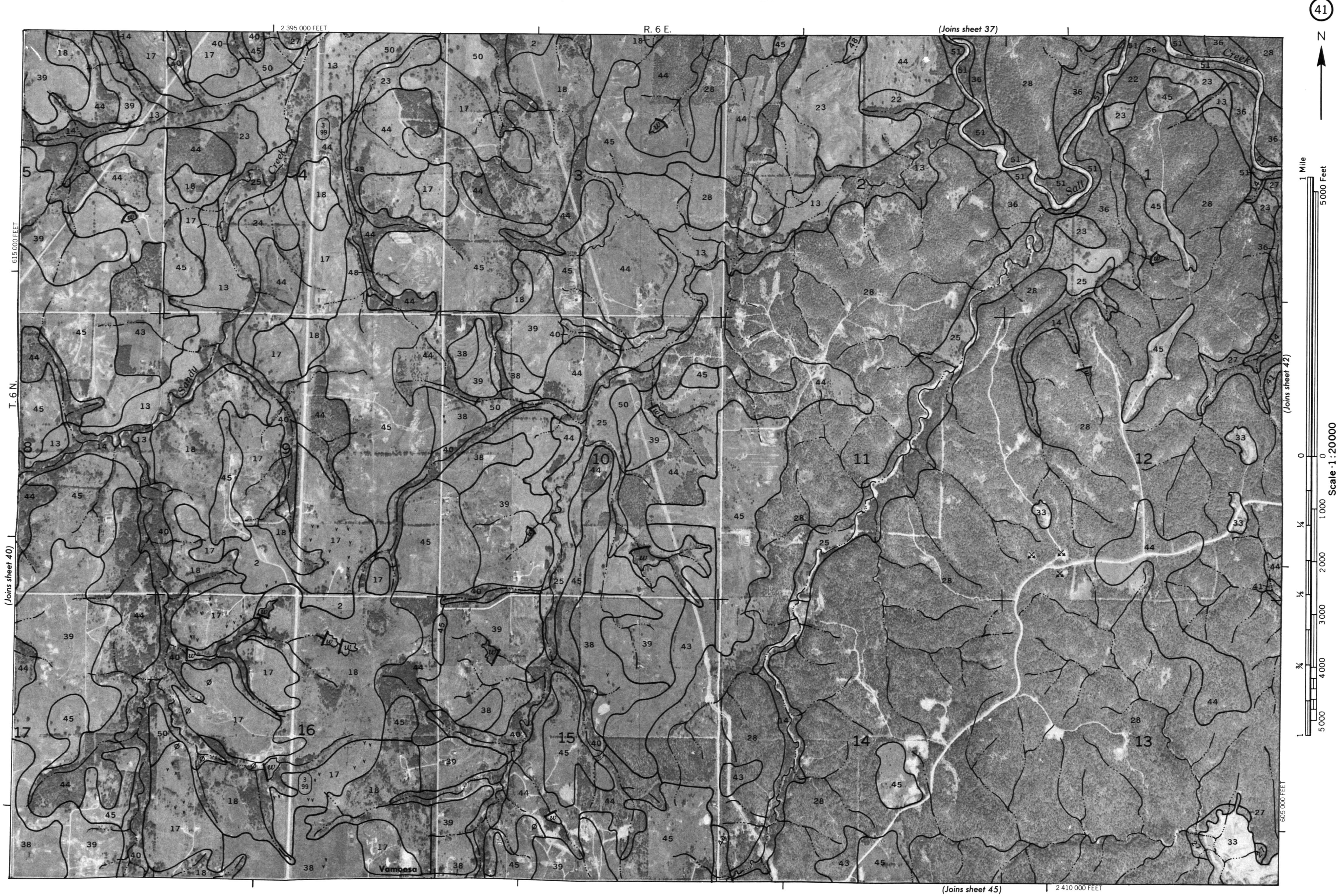
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SEMINOLE COUNTY, OKLAHOMA NO. 40

SEMINOLE COUNTY, OKLAHOMA NO. 41

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



42

N

1 Mile
5 000 Feet
Scale 1:20000
0 0 1000 2000 3000 4000 5000
¼ ½ ¾ 1

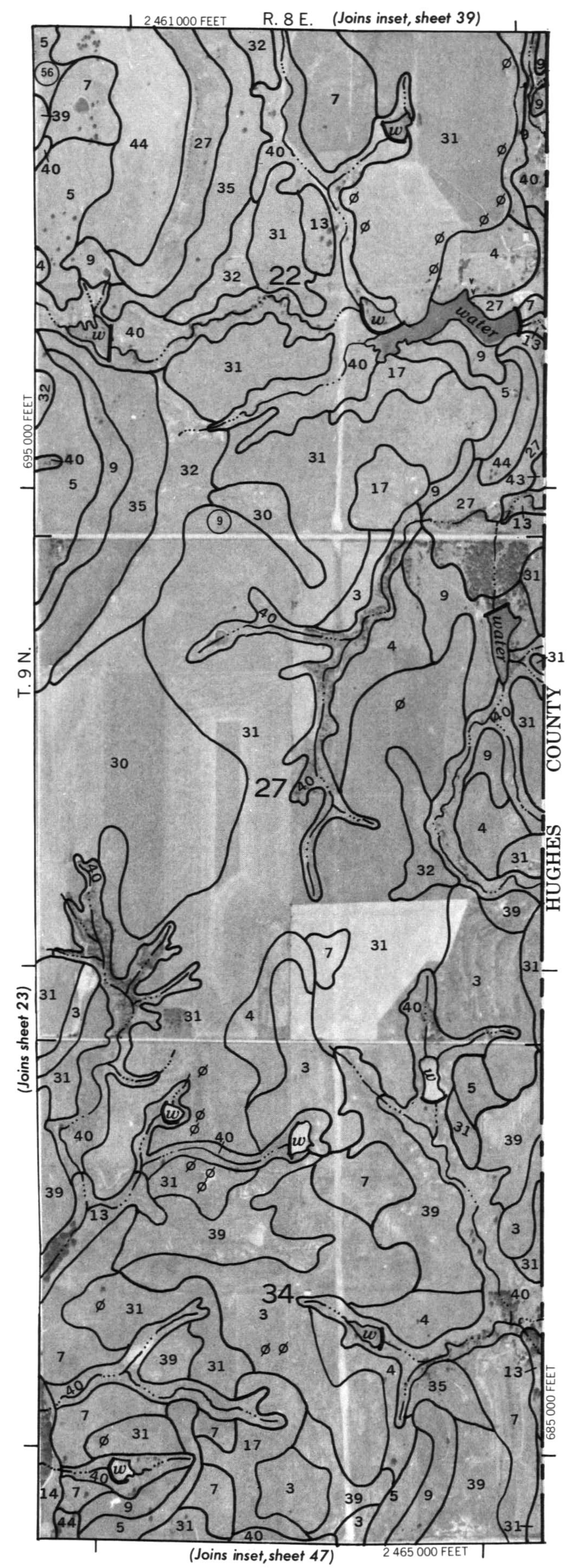
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SEMINOLE COUNTY, OKLAHOMA NO. 42

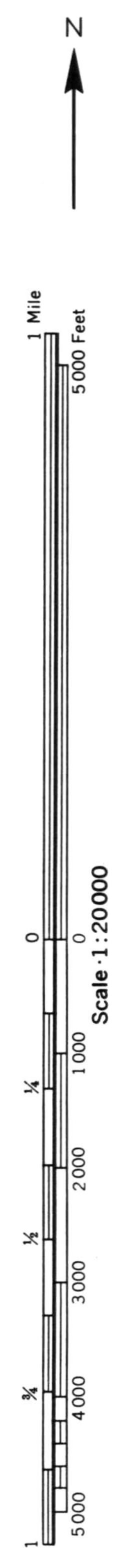
43

SEMINOLE COUNTY, OKLAHOMA NO. 43

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

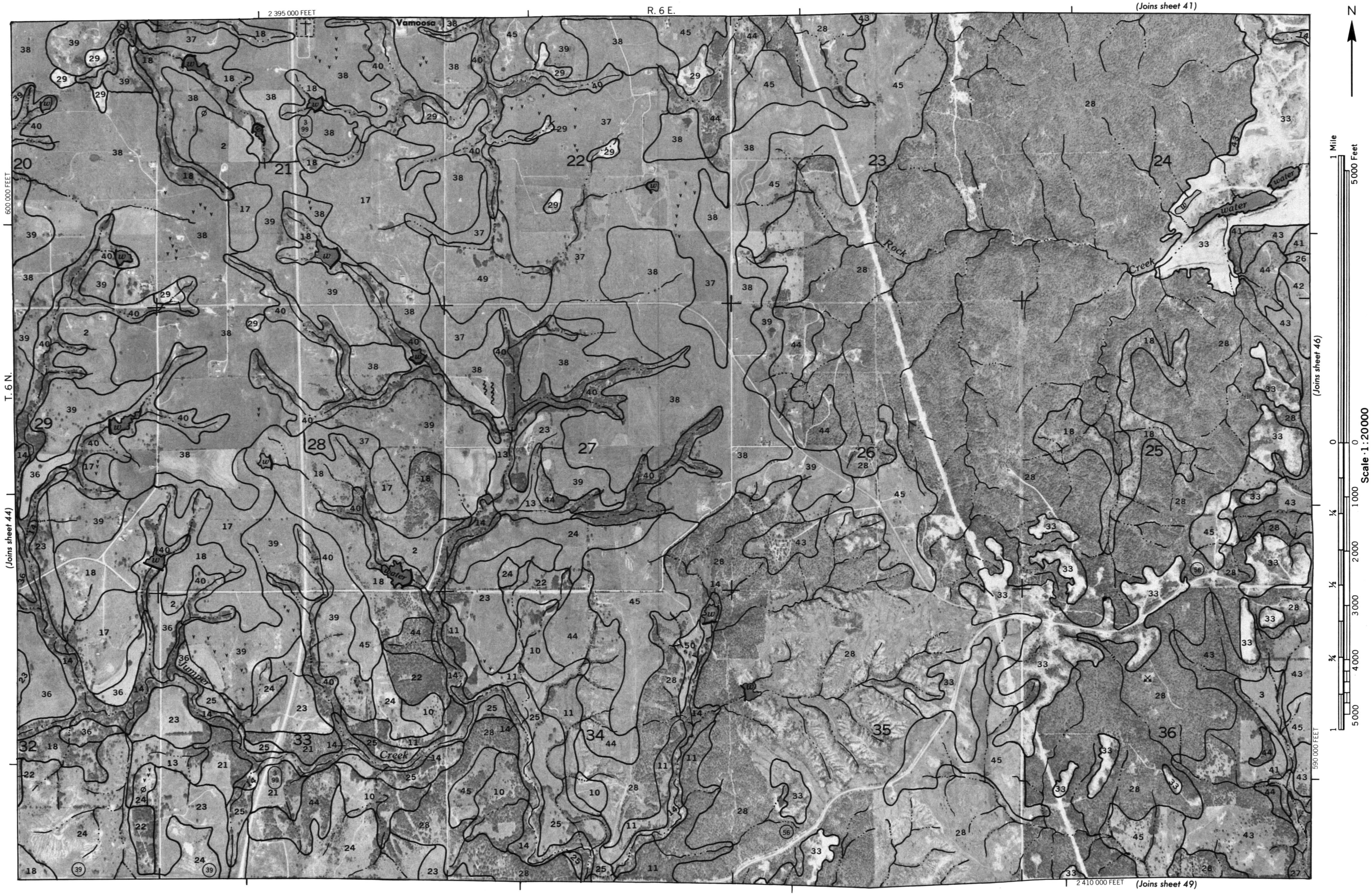


4000 AND 5000-FOOT GRID TICKS



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SEMINOLE COUNTY, OKLAHOMA NO. 44



SEMINOLE COUNTY, OKLAHOMA NO. 45

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

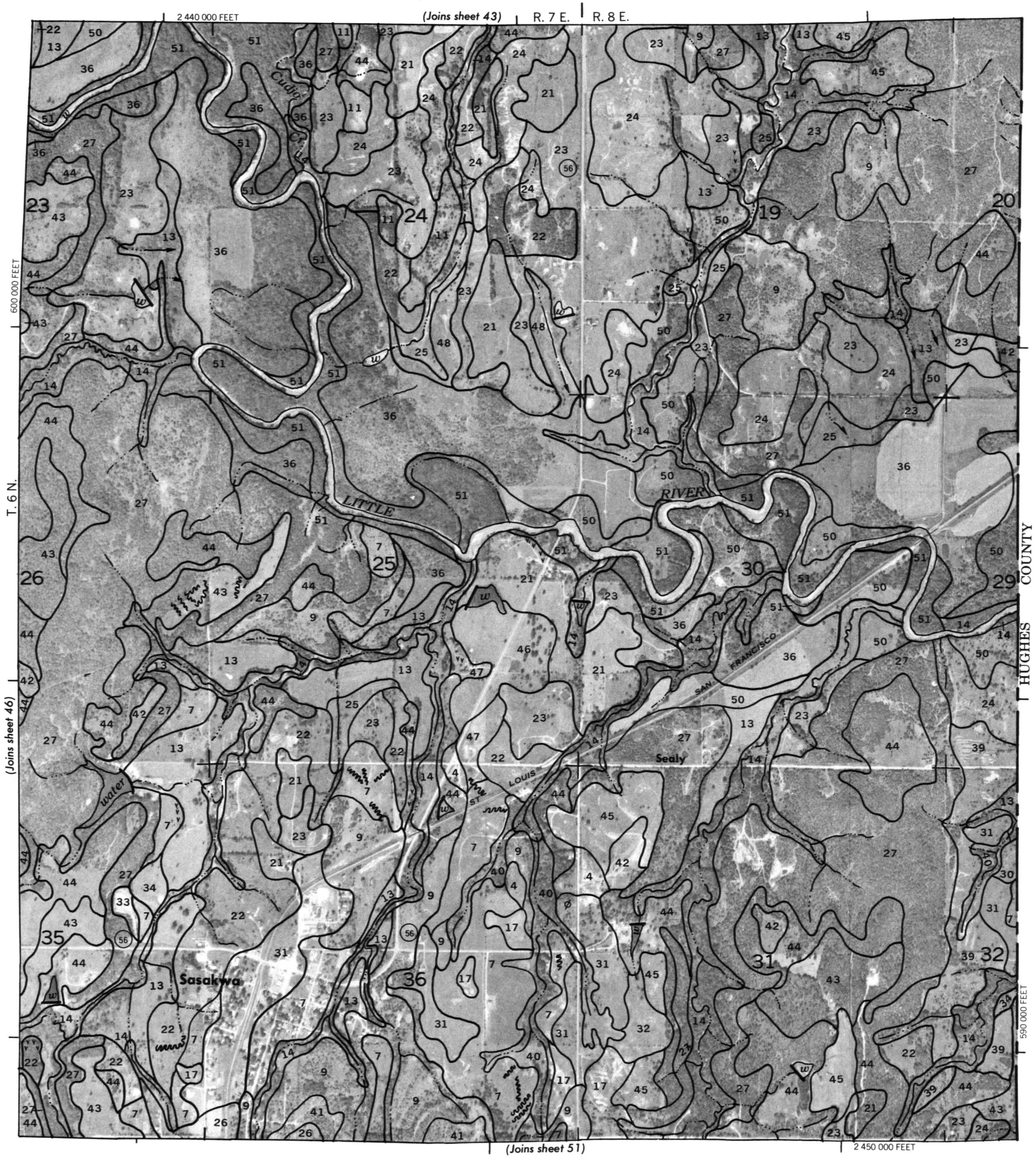
SEMINOLE COUNTY, OKLAHOMA — SHEET NUMBER 46

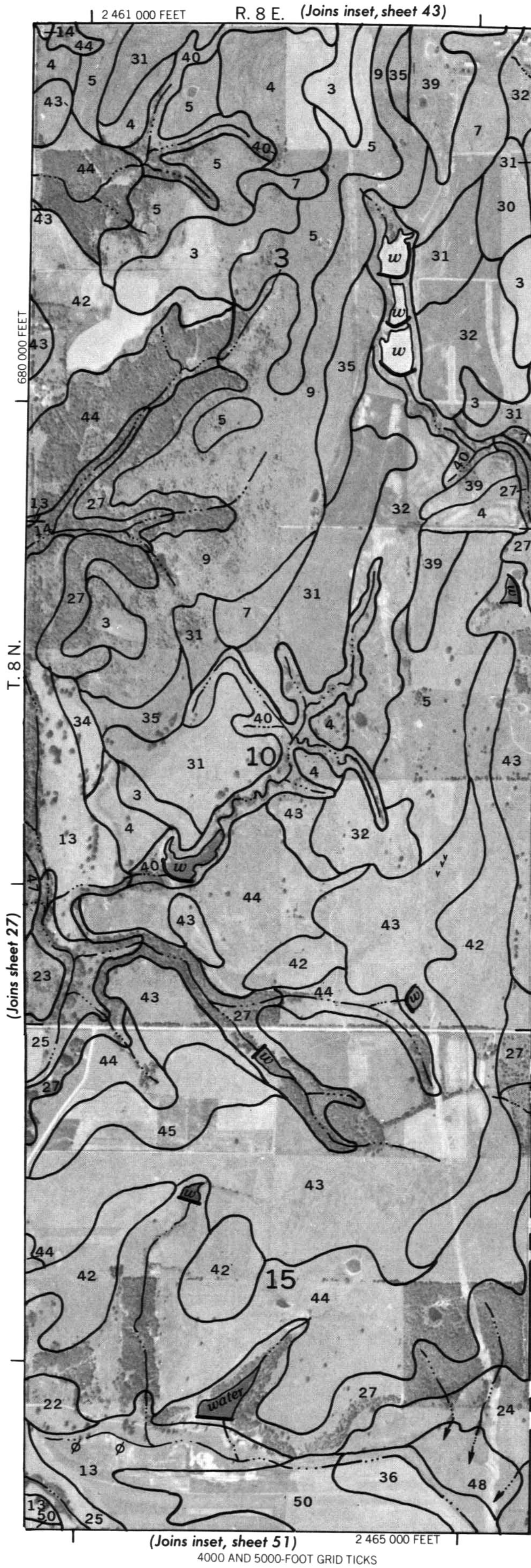
This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

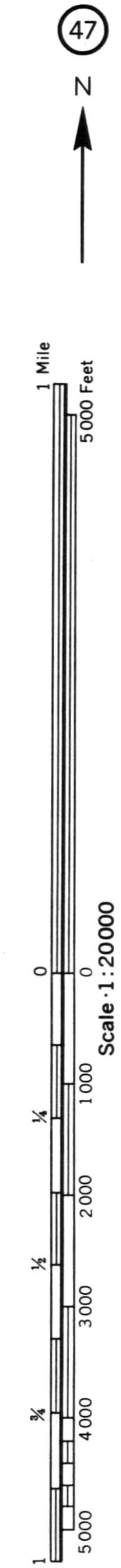
SEMINOLE COUNTY, OKLAHOMA NO. 46

SEMINOLE COUNTY, OKLAHOMA NO. 47

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

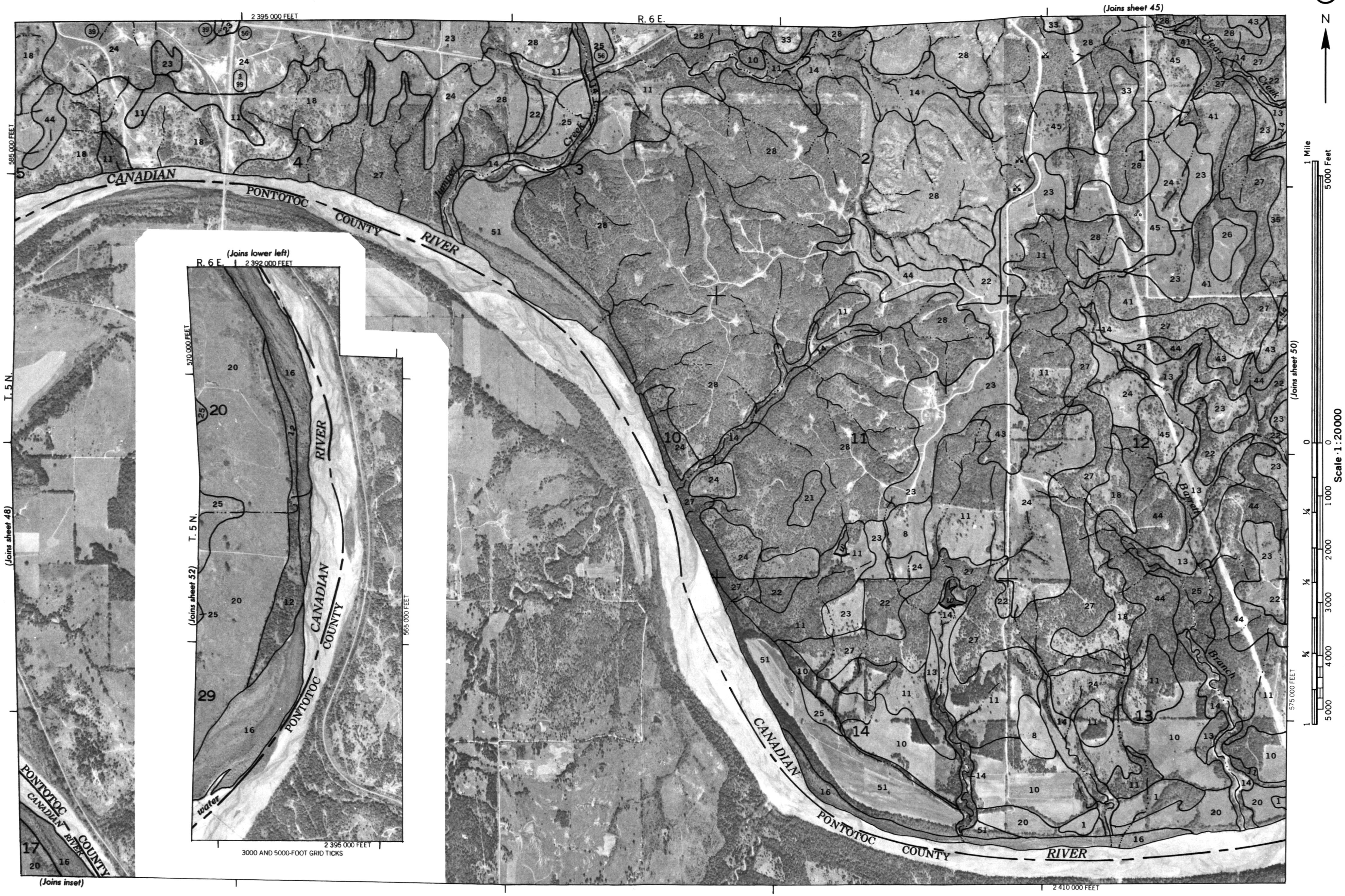






This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SEMINOLE COUNTY, OKLAHOMA NO. 48



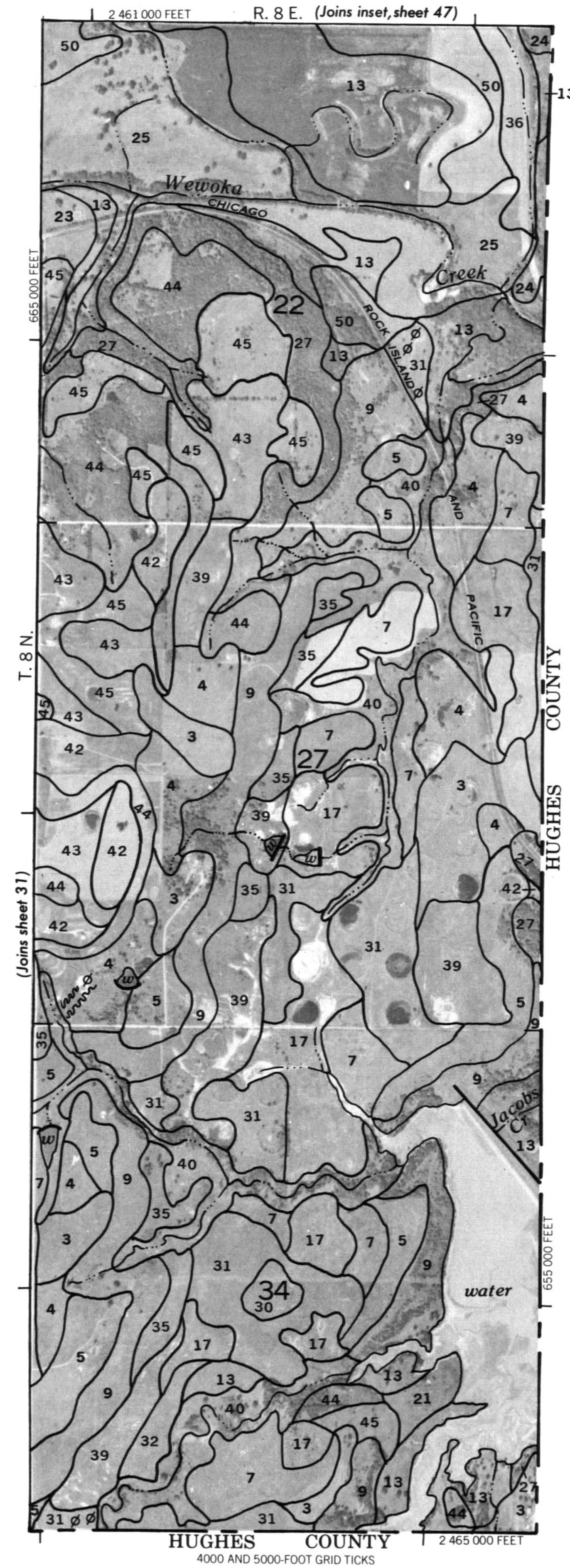
SEMINOLE COUNTY, OKLAHOMA NO. 49

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

51

N



1 Mile

5000 Feet

Scale 1:20000

SEMINOLE COUNTY, OKLAHOMA NO. 51

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SEMINOLE COUNTY, OKLAHOMA NO. 52